DRAFT

WORK PLAN

with

QUALITY ASSURANCE PROJECT PLAN

for

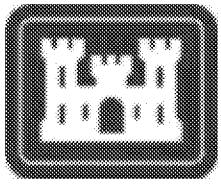
CLAM SAMPLING

at

River Operable Unit, Bradford Island
CASCADE LOCKS, OREGON

Prepared by

U.S. ARMY CORPS OF ENGINEERS
Portland and Seattle Districts



June 26, 2020

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TITLE AND APPROVAL SHEET
WORK PLAN WITH QUALITY ASSURANCE PROJECT PLAN (WP-QAPP)
CLAM SAMPLING
RIVER OPERABLE UNIT, BRADFORD ISLAND, CASCADE LOCKS, OREGON

This Work Plan with Quality Assurance Project Plan (WP-QAPP) describes sampling activities and Data Quality Objectives (DQOs) for clam sampling at the River Operable Unit, Bradford Island, Cascade Locks, OR. The QAPP is based on the *Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans Guidance (EPA 2009).*

_____ _____

Chris Budai, Project Manager, NWP Date

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Kristen Kerns, Clam Sampling Technical Lead, NWS Date

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Alison M. Suess, Ph.D., Chemist, NWS Date

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LIST OF ACRONYMS

µg/L	microgram per liter
CCB	continuing calibration blank
CCV	continuing calibration verification
CoC	chain of custody
COPC	contaminant of potential concern
DL	detection limit
DoD ELAP	Department of Defense Environmental Laboratory Accreditation
DoD QSM	Department of Defense Quality Systems Manual
EDD	electronic data deliverables
EPA	United States Environmental Protection Agency
GC-MS	gas chromatography mass spectroscopy
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICB	initial calibration blank
ICV	initial calibration verification
JHA	Job Hazard Analysis
LCS	laboratory control sample
mg/kg	milligram per kilogram
MS	matrix spike
MSD	matrix spike duplicate
ODEQ	Oregon Department of Environmental Quality
OU	Operable Unit
PAH	Polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDT	Project Delivery Team
POC	point of contact
PM	Project Manager
PQO	Project Quality Objectives
QC	quality control
RI	Remedial Investigation
RL	reporting limit
SOP	Standard Operating Procedure
SSHP	Site Safety Health Plan
SVOC	Semi-volatile organic contaminant
TAG	Technical Advisory Group
USACE	United States Army Corps of Engineers
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
WP-QAPP	Work Plan with Quality Assurance Project Plan

1. PROJECT MANAGEMENT AND OBJECTIVES

1.1. Project Organization, Responsibilities and Authority

The Project Delivery Team (PDT) for this Work Plan with Quality Assurance Project Plan (WP-QAPP) includes members from the US Army Corps of Engineers (USACE) Portland and Seattle Districts.

The project team provides the overall framework for the data collection approach by defining project objectives and data quality requirements, and ensuring that they are met during the execution of the project. Project updates will be shared with the Technical Advisory Group (TAG) who will be provided final copies of the WP-QAPP by the USACE Project Manager (PM). The roles of the project team members are described further in this section. Organization of the project is presented in Figure 1 and Table 1.

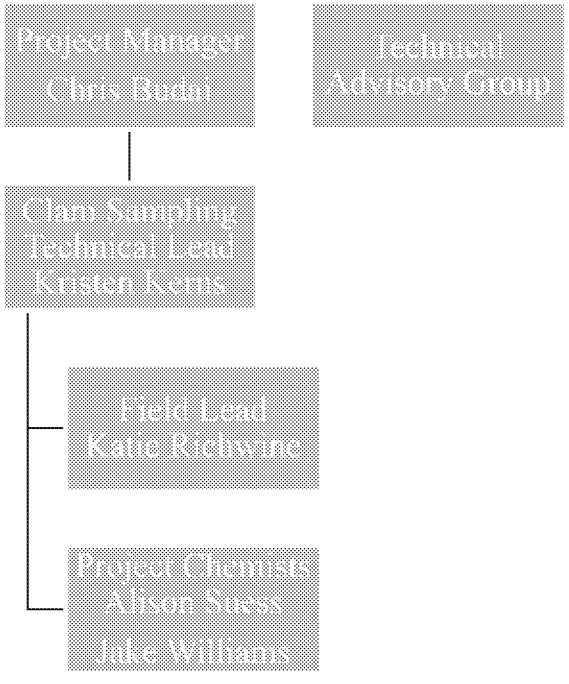

Figure 1. Project Organization Chart

Table 1. Project Organization and Distribution List

Personnel	Contact Information	Title
USACE		
Chris Budai	333 SW 1st Ave Portland, OR 97204 Phone: 503-808-4725 Email: christine.m.budai@usace.army.mil	Project Manager
Kristen Kerns	4735 E. Marginal Way S Seattle, WA 98134 phone: 206-764-3474 Kristen.kerns@usace.army.mil	Clam Sampling Technical Lead
Alison M. Suess, Ph.D. **Jake Williams**	4735 E. Marginal Way S Seattle, WA 98134 phone: 206-764-3264 alison.m.suess@usace.army.mil phone: 206-316-3157 Jacob.a.williams@usace.army.mil	Project Chemists (primary and backup)
Katie Richwine	4735 E. Marginal Way S Seattle, WA 98134 phone: 206-764-3465 Kathryn.A.Richwine@usace.army.mil	Field Lead

1.1.1. Communication Pathways

Communication is a key to the success of this project. Communication pathways describe the points of contact for resolving sampling and analysis problems, for distributing data to users, soliciting concurrence and obtaining approval between project personnel and contractors. Communication pathways are summarized in

Table 2.

Table 2. Communication Pathways

Communication Driver	Responsible Entity	Name Phone Number	Procedure (timing, pathway, etc.)
USACE management for this project Overall direction and Point of Contact for public	Project Manager	Chris Budai 503-808-4725	Assures that the overall direction of the project is consistent with USACE guidance Liaison with the Public
QAPP approval Schedule, budget and technical issues Changes to schedule and budget Oversight of final report Provides coordination among team members	Technical Lead	Kristen Kerns 206-764-3474	Coordinates with Project Manager, Project Lead, Chemist and Field Lead on project technical issues Reports to USACE PM regarding schedule, budget, and technical issues Notifies USACE PM of significant changes in execution or schedule Oversee USACE writing of final report and distribution to reviewers Provides input to QAPP and data reports
Writes QAPP with input from technical team members. Laboratory and data validation	Project Chemists	Alison M. Suess, Ph.D. 206-764-3264 Jake Williams 206-316-3157	Oversees writing of QAPP and Activity Hazard Analysis (AHA) and ensures revision approval within agreed timeframe Oversees laboratory work Writes data validation report Provides laboratory and data validation components of QAPP
Provide direction to field teams on sample collections Delivery of samples to laboratory Sampling activities summary Ensures compliance with AHA, and Dive Team safety plan	Field Lead	Katie Richwine 206-764-3465	Daily communication with team members during sampling events Coordinates with Project Chemist and laboratory for sample delivery Documents all field activities in Final Monitoring Report Briefs field team on AHA and documents noncompliance Coordinates with Project Chemist

1.1.2. USACE Personnel Responsibilities and Qualifications

USACE Project Manager

The project manager (PM), Chris Budai, is responsible for the execution of the scope, schedule, and budget for the Bradford Island project. She is the primary POC for communications with stakeholders. The USACE PM also has the authority stop work of USACE staff. The USACE PM is the primary document controller for the WP.

USACE Clam Sampling Technical Lead

The Technical Lead, Kristen Kerns, will oversee all activities of the USACE project delivery team (PDT), including quality assurance reviews, and maintain regular coordination to ensure adequate and timely flow of information for all work.

USACE Project Chemists

The Project Chemist, Alison M. Suess, Ph.D. (backup: Jake Williams), is directly responsible for laboratory coordination, shipping of samples to the project laboratories, and matters related to chemistry. They are responsible for providing additional guidance to the Field Sampling Lead (Katie Richwine) in any matters relating to sampling, project chemistry, and data quality.

Field Sampling Lead/Site Health and Safety Officer

Katie Richwine is the designated field sampling lead and site safety and health officer (SSHO) for this effort. She is responsible for coordinating the sampling with relevant Bonneville Project staff, execution of sampling, and shipping of samples to the project laboratories, and field safety briefings. She may communicate directly with the PM, Technical Lead, and Project Chemists as needed during the field sampling event.

Special Training Requirements and Certifications

Project staff shall be qualified to perform their assigned jobs. Field sampling personnel conducting or monitoring sampling activities are to be trained by the field sampling lead in accordance with established USACE protocols.

Field Staff

All project staff participating in on-site field activities shall have current HAZWOPER training in accordance with 29 Code of Federal Regulations (CFR) Part 1910.120, or be directly supervised by personnel with current HAZWOPER training. The technical lead and/or field sampling lead has HAZWOPER training in accordance with the same standard as well as a current certification in first aid and CPR.

Laboratory Contact

The analytical laboratories and applicable information that will be used for this project are listed below in **Error! Not a valid bookmark self-reference.**.

Table 3. Analytical Laboratories, Contacts, and Analyses

Lab Name	Lab Address	POC	Contact Info	Role
U.S. Army Engineer Research and Development Center (ERDC)	USACE ERDC EL EPC B3299 3909 Halls Ferry Road Vicksburg, MS 39180	Primary: Jenifer Milam Netchaev	Jenifer.m.netchaev@erdc.dren.mil Jenifer.m.netchaev@usace.army.mil 601-634-7431	Project Manager, Research Chemist
		Alternate: Tony Bednar	Anthony.J.Bednar@usace.army.mil 601-634-3652	Laboratory Director, Research Chemist

1.1.3. Technical Advisory Group Personnel Responsibilities and Qualifications

Technical Advisory Group members represent their respective agencies and provide technical review of the QAPP.

1.2. Project Planning

1.2.1. Project Planning (Scoping)

Several planning meetings were held within USACE and with TAG members. Topics discussed in these meetings include:

- Schedule
- Data Collection
- Analytes

The outcomes of the meetings are documented by incorporation into this WP-QAPP.

1.2.2. Problem Definition, Site History, and Background

USACE conducted a Remedial Investigation and draft Feasibility Study for the in water portion of Bradford Island, known as the River Operable Unit (OU), in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Executive Order 12580. As part of the Feasibility Study process, USACE conducted a baseline risk assessment, which found unacceptable risk to human health and the environment from exposure to PCB contaminated sediment in the River OU. Some of the historic clam data used to inform the presence of unacceptable risk included three sampling events conducted in 2007, 2008, and 2011.

In September 2007, prior to hydraulic dredging along the northern shoreline, sediment and clam samples, from the vicinity of the three former debris piles, were collected following the objectives and methods documented in the River OU QAPP (URS 2007b). These samples were collected from within the

footprint of the planned sediment removal area. Five sediment samples and four co-located clam composite samples were collected. Clam tissue was scarce at one of the five sediment locations and therefore could not be collected.

Sediment and clam tissue were again collected in February and March 2008 after the sediment removal from 17 and 19 of the randomly selected stations in the Forebay and Reference Area, respectively (URS 2008f).

Following finalization of the Remedial Investigation, additional bass, clam, and sediment samples were collected from the Forebay in September and October 2011. Co-located sediment and clam samples were collected at seven locations along the north-shore of Bradford Island in the areas suggested by Oregon DEQ as most likely to be influenced by Upland sources. Sediment and clam samples were successfully collected at all seven proposed sample locations; however, only six of the locations yielded enough clam tissue for the planned analysis. Sediment and tissue samples were analyzed for PCBs (Aroclors and 209 congeners), metals, PAHs, pesticides, butyltins, and SVOCs.

Based on the series of clam and sediment data collected during the previously mentioned sampling events, a 1:1 correlation was generally observed between clam tissue and sediment for total PCBs. There was also a decreasing trend in tissue concentrations when comparing northern shoreline tissue samples to southern shoreline tissue samples around Bradford Island.

USACE is currently in the process of confirming and updating the conceptual site model for the River Operable Unit. The intent of this data is to help inform the current site conditions for the River OU to aid in development of remedial action alternatives in the feasibility study.

Clam tissue data from 2007, 2008, and 2011 is summarized in Appendix A of this QAPP.

1.3. Project Quality Objectives and Measurement Performance Criteria

1.3.1. Development of Project Quality Objectives Using the Systematic Planning Process

Project Quality Objectives (PQOs) are developed through the systematic planning process as described in the UFP-QAPP Guidance. They are used for determining the type, quantity, and quality of data as described in Table 4.

Table 4. Project Quality Objectives

Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytic Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop the Detailed Plan for Obtaining Data
1) Are there any significant differences in River OU (Site) clam tissue analyte concentrations relative to the reference area?	Evaluate tissue analyte concentration differences in clams for the Site versus reference area.	The evaluation will use results from the analysis of clam composite samples collected at the Site and analysis of clam composite samples collected in the reference area. Locations for collection are based on previous collection efforts performed as part of Remedial Investigation and post-Remedial Investigation sampling activities.	Tissue samples will be analyzed for analytes identified in Table 5. Clams will be collected from the northern and southern shorelines of Bradford Island, as well as Goose Island and the Oregon shoreline. Timeframe targeted for clam collection is August and September 2020.	Statistically evaluate the Site clam tissue analyte concentrations relative to the reference area to determine if there are statistically significant differences.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).
2a) Are there any changes to Site clam tissue analyte concentrations over time?	Evaluate tissue analyte concentration changes at the Site for clams collected during 2007, 2008, and 2011and tissue collected in 2020.	The evaluation will use results from the analysis of clam composite samples collected at the Site and results of analysis of clam composite samples collected form the Site during previous sampling efforts in 2007, 2008, and 2011.	Tissue samples will be analyzed for analytes identified in Table 5. Clams will be collected from the northern and southern shorelines of Bradford Island, as well as Goose Island and the Oregon shoreline. Timeframe targeted for clam collection is August and September 2020. Historic clam tissue data consists of samples from 2007, 2008, and 2011.	Statistically evaluate the Site clam tissue analyte concentrations from 2020 relative to 2007, 2008, and 2011 data to determine if there are statistically significant differences in the datasets.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).
2b) Are tissue concentrations different for the northern shoreline of the Site over time?	Evaluate tissue analyte concentration changes along the northern shoreline of Bradford Island for tissue collected in 2011and tissue collected in 2020.	The evaluation will use results from the analysis of clam composite samples collected from reoccupation of historic locations along the northern shoreline of Bradford Island	Tissue samples will be analyzed for analytes identified in Table 5. Clams collected from reoccupation of historic locations along the northern shoreline of Bradford Island. Timeframe targeted for clam collection is August and September 2020. Historic clam tissue data consists of samples from 2011.	Statistically evaluate the Site clam tissue analyte concentrations from 2020 relative to 2011 data to determine if there are statistically significant differences in the datasets for the northern shoreline samples only.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).
3) Are there any significant differences between clam concentrations in subareas of the Site?	Evaluate tissue analyte concentration differences in clams for the Site versus reference area.	The evaluation will use results from the analysis of clam tissue composite samples collected using a Sampling Area approach. Sampling Area locations in the forebay area were guided by historic clam and sediment sampling data.	Tissue samples will be analyzed for analytes identified in Table 5. Clams will be collected from the northern and southern shorelines of Bradford Island, as well as Goose Island and the Oregon shoreline. Timeframe targeted for clam collection is August and September 2020.	Statistically evaluate the Site clam tissue analyte concentrations to determine if there are significant differences among Sampling Areas within the Forebay.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).
4) Are there any gradients in Site clam tissue PCB concentrations along the northern shoreline of Bradford Island that might identify source areas or areas of elevated concentration to focus remedial design?	Evaluate PCB tissue concentrations in clams to elucidate potential contaminant sources along the northern shoreline of Bradford Island.	The evaluation will use results from the PCB analysis of clam composites collected in decision units along the northern shore. PCB results from triplicate samples from each north shore subarea will be used to evaluate gradients along shore and to compare nearshore and offshore.	Tissue samples will be analyzed for analytes identified in Table 5. Clams collected from the northern shoreline of Bradford Island. Timeframe targeted for clam collection is August and September 2020.	Statistically and visually evaluate data along the northern shoreline for potential gradients in concentrations that may either be statistically or visually significant.	See Data Usability Assessment (Section 5.1).	See Sampling Design, Location, and Methods (Sections 2.1).

Table 5. Sample Locations, Media, Methods, Analytes of Interest, and Detection and Reporting Limits

Sample Locations and Media	Method	Analytes	Tissue DL	Tissue RL
Forebay and Reference Area Clam Tissue	PCB Congeners, EPA 8082 Modified (ERDC) with subset EPA 1668C (ERDC commercial subcontractor)	153 PCB congeners (ERDC) with subset 209 PCB congeners (ERDC commercial subcontractor)	0.015 - 0.075 (µg/kg ww) (ERDC)	0.10 - 0.03 (µg/kg ww) (ERDC) with subset 0.20 - 0.60 (µg/kg ww) (ERDC commercial subcontractor)
Forebay and Reference Area Clam Tissue	Organochlorine Pesticides, EPA 8081 (ERDC)	Organochlorine Pesticides	(µg/kg ww)	(µg/kg ww)
		2,4'-DDD	TBD	0.5
		2,4'-DDE	TBD	0.5
		2,4'-DDT	TBD	0.5
		4,4'-DDD	TBD	0.5
		4,4'-DDE	TBD	0.5
		4,4'-DDT	TBD	0.5
		alpha-BHC	TBD	0.5
		beta-BHC	TBD	0.5
		delta-BHC	TBD	0.5
		gamma-BHC	TBD	0.5
		alpha-Chlordane (cis)	TBD	0.5
		gamma-Chlordane (trans)	TBD	0.5
		Dieldrin	TBD	0.5
		Endosulfan I	TBD	0.5
		Endosulfan II	TBD	0.5
		Endrin	TBD	0.5
		Endrin Aldehyde	TBD	0.5
		Methoxychlor	TBD	0.5
Forebay and Reference Area Clam Tissue	Mercury, EPA 7471 (ERDC)	Mercury	TBD	2.0 (µg/kg ww)
Forebay and Reference Area Clam Tissue	Total Lipids, Sulfo-Phospho-Vanillin Colorimetric Method (Van Handel 1985) (ERDC)	Total Lipids	TBD	0.002%

Table 6. Sampling Summary (Number of Primary and Quality Control Samples)[1]

Matrix	Analyses	Primary Samples	Field Duplicate Samples[2]	MS/MSD[3]	Total Number of Field Sample Analyses
Forebay and Reference Area Clam Tissue	PCB Congeners	62	7	4/4	77
	Organochlorine Pesticides	42	5	3/3	53
	Mercury	42	5	3/3	53
	Total Lipids	42	5	0	47

1. Does not include laboratory quality control samples such as laboratory duplicates and control spikes. The mass required provided by the laboratory and listed in Table 10 includes sufficient mass for all field and laboratory quality control samples.
2. Field duplicate samples will be collected at a rate of 1 per 10 primary samples.
3. MS/MSD samples will be collected at a rate of 1 pair per 20 primary samples.

1.3.2. Measurement Performance Criteria

Performance criteria specify the acceptable levels of uncertainty in measured data that can be used to support project decisions and achieve DQOs. Performance criteria for the analytical methods are specified in the laboratory procedures and are compliant with DoD QSM 5.1 unless otherwise noted. Any data which fall outside of these criteria must be justified, and the effects on decisions must be assessed.

1.4. Secondary Data Evaluation

No secondary data will be collected.

1.5. Project Overview and Schedule

Through project planning, the project team has agreed on the purpose of the project, the environmental questions that are being asked, and the environmental decisions that must be made. Project quality objectives have been developed specifying the type, quantity, and quality of data needed to ensure that project data can be used for the intended purpose to answer specific environmental questions, support environmental decisions, and determine technical activities that will be conducted. Table 7 provides a summary of the project tasks to be completed and Table 8 describes the project schedule.

Table 7. Project Tasks

Plan, Prepare WP-QAPP & Obtain Laboratory Quote
• Prepare and finalize WP-QAPP; obtain laboratory quotes.
Sampling Tasks
• Collect reference area clams • Collect River OU clams
Analytical Tasks
• Analyze clam tissue composites
Quality Control Tasks
• Analytical methods QC will comply with DoD QSM or laboratory SOPs as applicable.
Secondary Data
• No secondary data will be collected.
Data Management Tasks

• Project Chemists will review and store analytical data.
Documentation and Records
• Field notes will be recorded in a field notebook or on field log sampling sheets, then scanned and electronically stored. • Field notes will contain the following: date and time of sample collection, weather conditions, sample identification number, type of sample, any procedural steps taken that deviate from those outlined in this WP-QAPP. • Laboratory analytical results will be stored.
Data Validation and Data Packages
• 100% of data packages will be validated through Stage 2A by the Project Chemists. All data packages will be delivered in sufficient detail to support the data validation..
Data Review Tasks
• The laboratory performing analyses of samples will verify that all data are complete for samples received. • Data will be validated using the principles of the *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (2008)*. • Validated data will be reviewed. • Data usability will be assessed. • Measurement performance criteria set in WP-QAPP checked. • Data limitations will be determined. Data compared to Project Objectives.

Table 8. Estimated Project Schedule

Task #:Description	Start	Finish
Task #1: Plan, Prepare WP-QAPP and Obtain Laboratory Quotes		
Prepare Draft WP-QAPP	1 May 2020	30 June 2020
TAG Review	1 July 2020	30 July 2020
Finalize WP-QAPP	1 August 2020	15 August 2020
Obtain laboratory quote, finalize, and receive sample containers	1 June 2020	30 September 2020
Purchase Field Equipment	1 July 2020	15 July 2020
Task #2: Field Work		
Reference area	15 August 2020	30 August 2020
River OU (BRZ permit required)	1 September 2020	30 September 2020
Task #3: Review Lab Data and Prepare Report		
Receive Data Deliverable from Lab	1 November 2020	1 November 2020
Data Validation	1 November 2020	30 December 2020
Draft and Final Data Reports	30 December 2020	30 March 2020

2. DATA GENERATION AND ACQUISITION

2.1. Sampling Tasks

Sample identification and field sampling will be performed following the protocols described in this section. Contingencies may arise during activities that will require modification of the general procedures outlined herein. Such modifications will be at the discretion of the field lead after consultation with the study technical lead and PM, the boat captain, and dive team in the field. All modifications will be recorded and document in the field or data report, as appropriate.

2.1.1. Sampling Process Design and Rationale

Clams will be collected from targeted areas in both the Site and reference area. In order to address the sampling specific PQOs for this effort, several sampling strategies have to be employed at the Site.

For the Site as a whole, target areas for sample collection will be identified as Sampling Areas, with a total of four Sampling Areas identified in the site. These four Sampling Areas have distinct geographic differences and will be the basis for evaluating potential tissue concentration differences on a per area basis within the site. With the exception of the northern shoreline Sampling Area, the goal will be to collect 4 clam composites from each of the Sampling Area.

For the northern shoreline of Bradford Island, the Sampling Area has been subdividing into 10 subareas, with six nearshore (A, B, C, D, E, F) and four offshore (G, H, I, J) subareas. Three sampling stations were identified for each subarea, with each station representing a discrete analytical sample. Sampling stations are an approximate 30x30ft square. For the offshore subareas (H, I, and J), the location for each of the three sampling locations was selected randomly from a sampling grid. For the nearshore areas (subareas A through G), two locations were randomly selected from the sampling grid, with the location of the third sampling station based on the historic sample collection locations conducted during 2011 post RI sampling. The sampling stations of those historic collection locations are also 30x30ft squares. Each subarea also has two randomly identified contingency sampling stations in the event that primary sampling stations do not have sufficient clams.

For the northern shoreline, PCB congener analysis will be conducted on clams from each sampling station, providing an analytical result for three stations per subarea. For all other analyses, clams will be combined into a subarea composite, such that one analytical result is provided for an individual composite from each of the 10 subareas. The results from the targeted, historic locations will be used to compare possible temporal changes along the northern shoreline. Sample coordinates and nomenclature are based on 2011 sample locations. Temporal changes for other portions of the site will include historic data from 2007 and 2008.

Table 9. Coordinate for reoccupation of historic sampling locations

Historic 2011 Sample Location for Reoccupation	Latitude (centroid of sampling station)	Longitude (centroid of sampling station)
P112	45.6427	-121.9350
P113	45.6428	-121.9356
P114	45.6428	-121.9362
P115	45.6427	-121.9374
P116	45.6427	-121.9393
P117	45.6429	-121.9395
P118	45.6426	-121.9386

Table 10. Clam composite scheme by location and analyte

Site	Number of samples collected (1 sample = approx. 30 individual clams)	Results per Analysis		
		PCB Congeners	OC Pesticides	Total Mercury
Northern Shoreline Sampling Area	30 samples (includes reoccupation of 7 historic sample locations) across 10 sub areas – A, B, C, D, E, F, G, H, I, J	30 analytical results (includes reoccupation of 7 historic sample locations)	10 analytical results (1 result from each sub area)	10 analytical results (1 result from each sub area)
Southern Shoreline Sampling Area	4 samples	4 analytical results	4 analytical results	4 analytical results
Oregon Shoreline Sampling Area	4 samples	4 analytical results	4 analytical results	4 analytical results
Goose Island Sampling Area	4 samples	4 analytical results	4 analytical results	4 analytical results
Reference Area	20 samples (10 from the southern shoreline and 10 from the northern shoreline)	20 analytical results	20 analytical results	20 analytical results

Reference area clams will be collected from two separate target areas along the northern and southern shorelines. Clams will be composited based on the general vicinity where divers collect clams. Clams from the northern and southern shorelines will remain separate when compositing.

Due to potential field constraints associated with diving, Sampling Areas may need to be prioritized for collection. The northern shoreline will be prioritized for collection in the event that areas need to be eliminated. At this time it is not anticipated that any areas will need to be eliminated from collection.

Appendix B provides maps of the target sampling locations for both the site and reference area.

2.1.2. Sample Collection Procedures

Clam Collection

The clam species targeted for collection is the Asian clam, *corbicula fluminea* (Photo X). Clam collection will be performed with the USACE dive team. A team of two divers will deploy by boat at both the Reference Area and Site. Divers will conduct collection of clams as prescribed below under "Clam Search and Level of Effort". Only whole, uncrushed clams should be collected. Divers will collect clams and place them in a mesh bag underwater. One mesh bag per collection area should be used, so not to mix clams from separate collection areas. Once divers have retrieved a sufficient number of clams from a location, they will resurface to transfer clams to a field team onboard the boat for processing.

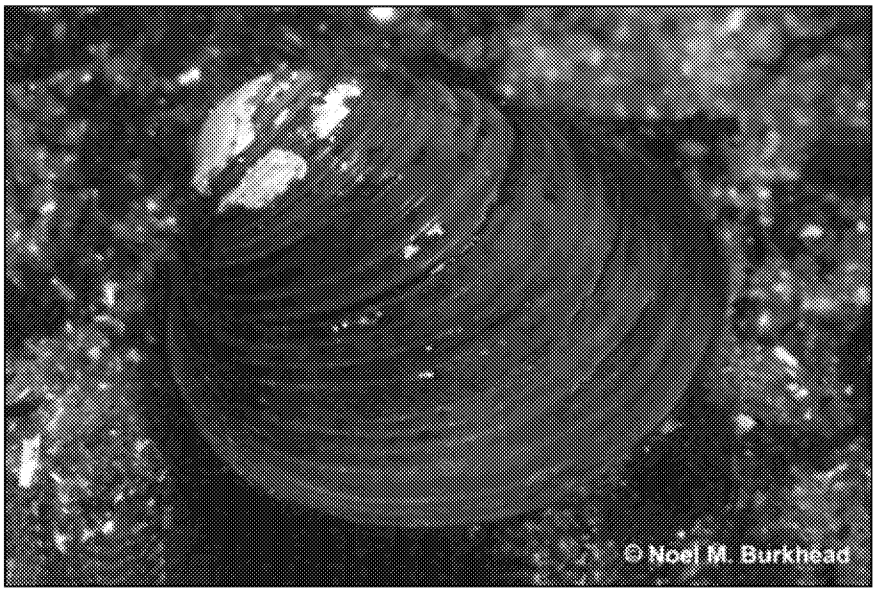

Figure 2. Asian Clam (*corbicula fluminea*) (Photo Source: USGS, https://nas.er.usgs.gov/)

Clam Search and Level of Effort

The diver will attempt to locate live clams by randomly overturning clastic (pebbles and cobbles) river deposits and excavating shallow areas (less than approximately six inches) using a spoon. The diver will spend up to 30 minutes collecting live clams per station. If inadequate sample volume is collected after attempting collection at contingency locations, the live clams that are collected will still be processed and submitted to the laboratory. Live clams will be composited to achieve a minimum biomass of 80 g of tissue (not including shell) needed for all chemical analyses. The number of live clams targeted per location is 20 to 30 in order to achieve a minimum mass of approximately 80g.

Field Processing of Clams

Upon retrieval of clams by the dive team, clams will be brought to field staff aboard the boat for processing. Processing will be conducted using clean, powder-free nitrile gloves. Any dead clams will be counted, recorded, and discarded from the sample. Clams will be rinsed with DI water to remove visible sediment then measured (on the longest length) and weighed (to the nearest whole gram). Sample information will be recorded on the tissue sampling form. Individual clams will be wrapped in aluminum foil then placed in pre-labeled plastic bags. Clams will be stored on wet ice in a cooler prior to overnight shipment to the laboratory. The laboratory will be responsible for shucking the clams.

2.1.3. Sample Naming Convention

Clams will be given an identification for each sample (or composite). Each sample will contain approximately 30 clams and a composite will be made of multiple samples. While mass and length will be recorded for individual clams within a sample, individual clams will not be assigned a sample ID number. The naming convention will include identification of whether the sample is from the Site ("BI") or reference area ("REF"), along with the date and sample/composite number. For samples collected within the Sampling Area along the northern shoreline, a sub area letter will also be assigned (A, B, C, D, etc.), as well as a sample station number (1, 2, 3). If the sample is a composite from within the subarea, the

sample will be identified by "COMP". For samples collected in other Sampling Areas, abbreviations will be used to identify the Sampling Area where a sample was collected (SO= southern shoreline Sampling Area; GI=Goose Island Sampling Area; OR=Oregon shoreline Sampling Area). Example identification formatting is provided below:

Examples for northern shoreline Sampling Area:

BI-1Sep2020-A-03; BI-1Sep2020-A-COMP (primary sample)

BI-1Sep2020-A-03FD (field duplicate associated with primary sample)

BI-1Sep2020-A-03MS (matrix spike associated with primary sample)

BI-2Sep2020-A-03MSD (matrix spike duplicate associated with primary sample)

Example for other Sampling Area:

BI-1Sep2020-SO-02

Example for reference area:

REF-15Sep2020-04

Table 11. Methods, Sample Containers, Volumes, Preservation, and Holding Times for Clam Tissue Samples

Analytes	Analytical Method	Container Type/Quantity	Preservation (all 4°C ± 2°C)	Minimum Mass per Sample[1] (g)	Holding Time
PCB congeners	EPA 8082 Modified (ERDC) with subset EPA 1668C (ERDC commercial subcontractor)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	40	Thawed: 14 days Frozen: 1 year
Organochlorine Pesticides	EPA 8081 (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	30	Thawed: 14 days Frozen: 1 year
Mercury	EPA 7474 (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	6	Thawed: 14 days Frozen: 1 year
Total Lipids	Sulfo-Phospho-Vanillin Colorimetric Method (Van Handel 1985) (ERDC)	Aluminum foil inside Ziploc bag	Thawed: 4 °C ± 2 °C Frozen: -20 °C	3	Thawed: 14 days Frozen: 1 year

1. Tissue mass listed includes all laboratory and field quality control samples, such as blank, duplicate, LCS/LCSD, MS/MSD, and potential re-extraction.

2.1.4. Decontamination Procedures

All potential sources of contamination in the field will be identified by the field lead, and appropriate steps will be taken to minimize or eliminate contamination. Divers will be rinsed with site water between collection stations. Ice chests will be lined with a garbage bag and sealed prior to shipment to prevent potential cross contamination. To avoid contamination from melting ice, the wet ice will be placed in separate plastic bags. Prior to each use, sampling equipment will be cleaned with Alconox® or Liquinox® phosphate-free detergent and rinsed with deionized water.

2.1.5. Field Equipment Calibration, Maintenance, Testing and Inspection Procedures

No field equipment requires calibration, maintenance, testing and inspection. If any sampling procedures are changed to include use of field equipment, that information will be included in the field notes.

2.1.6. Supply Inspection and Acceptance Procedures

Inspection and acceptance of supplies and consumables will be conducted prior to field work in order to ensure that the appropriate type and quantity of supplies are brought to the field. Any supplies and consumables used in the sample collection process or instrument calibration will be inspected.

2.1.7. Field Documentation Procedures

Field documentation provides a permanent record of field activities and can be used, if necessary, to trace possible introduction of field sampling error.

Field notes will be maintained either in a bound logbook, or on field sampling log sheets. After fieldwork is complete, electronic copies will be made of the field notes and the electronic copies will be stored in the project files. All information pertinent to the sampling effort will be recorded in the field notes. Documentation in the field notes will be at a level of detail sufficient to explain and reconstruct field activities without relying on recollection by the field team members. The Field Sampling Lead has overall responsibility for accuracy and completeness of field notes. Each page/form will be consecutively numbered. All entries will be made in indelible ink and corrections will consist of lined-out deletions. As a minimum, the applicable items for the entry into the field notes are listed below.

<u>General Information</u>

- Date
- Time
- Weather conditions
- Names of personnel present

<u>Sampling Information</u>

- Location of sample
- Type of sample
- Sample identification number
- Associated QC samples

- Any unusual observations

2.1.8. Sample Delivery

Sample delivery procedures include packaging, labeling, and shipment to the laboratory. These procedures are designed (1) to preserve sample quality so that analyses will yield results representative of site conditions, (2) to protect and inform sample handlers, including shippers and laboratory personnel, and (3) to provide a paper trail to allow cross referencing of sample collection locations with analytical results.

All samples will be labeled with its own sample identification number and all other applicable information. Samples will be shipped with wet ice overnight via FedEx to the laboratory. The shipping address for the laboratory is:

USACE ERDC EL EPC B3299
3909 Halls Ferry Road
Vicksburg, MS 39180

2.1.9. Sample Custody

A sample is in "custody" if it is in the actual physical possession of authorized personnel or in a secure area that is restricted to authorized personnel. Custody procedures ensure data authenticity and defensibility. Chain of custody (CoC) forms will accompany sample containers during transit to the laboratory and be checked by the laboratory upon receipt.

2.2. Analytical Tasks

Once samples have been collected, they will be analyzed by the laboratories. The Project Chemists will validate the analytical data.

The following sections address all components of project-specific analytical measurements; method and laboratory-specific QC measurements; acceptance criteria; corrective actions; calibration procedures; equipment and supply maintenance; testing; and inspection requirements. Modifications to approved procedures, alternate procedures, or additional procedures are to be pre-approved in writing by the Project Chemist.

2.2.1. Analytical Methods

See Table 10 for analytical methods that will be used for analysis.

2.2.2. Analytical Instrument Calibration Procedures

Calibration procedures and instrumentation shall be consistent with the requirements of the methods.

2.2.3. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures

Maintenance, testing, and inspection procedures shall be consistent with the requirements of the methods.

2.3. Quality Control Samples

Quality control (QC) samples are collected and analyzed for the purpose of assessing the quality of the sampling and analysis performed by the field personnel and the primary laboratory. The Project Chemist will coordinate selection of QC samples prior to each sampling event.

2.3.1. Field Quality Control Samples

2.3.1.1. Field Duplicates

Field duplicate samples will be collected at a rate of 1 per 10 primary samples.

2.3.1.2. Trip Blanks

No trip blanks will be collected for this sampling event as they are not necessary for the selected methods.

2.3.1.3. Equipment Rinse Blanks

No equipment rinse blanks will be collected since there is no reusable sampling equipment such as scoops or containers utilized in bass and crayfish collection.

2.3.2. Analytical Method Quality Control Samples

Method QC includes the analyses and activities required to ensure that the analytical system is in control prior to and during an analytical run. Method QC requirements for this project include the following: method blanks, surrogate spikes, matrix spikes/matrix spike duplicate pairs, and laboratory control samples.

2.3.2.1. Method Blanks

Method blanks are composed of organic/analyte-free water processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure. Method blanks verify that the measurement system is free of contamination.

2.3.2.2. Laboratory Control Samples (LCS)

Laboratory control sample (LCSs) are composed of organic/analyte-free water spiked with verified amounts of analytes. They are generally used to establish intra-laboratory or analyst-specific precision or to assess the performance of all or a portion of the measurement system. The LCS is analyzed in the same manner as a sample, including preservation.

2.3.2.3. Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD samples are used to evaluate matrix interference and to determine laboratory accuracy and precision. For methods that require MS/MSD, MS/MSD samples will be collected at a rate of 1 pair per 20 primary samples.

2.3.2.4. Surrogates

Surrogates are substances with properties that mimic the analyte of interest. A surrogate is unlikely to be found in environment samples, and is therefore added to them for quality control purposes.

3. ASSESSMENT AND OVERSIGHT

Laboratory and field operations have established policies and procedures, and they designate authorities for implementing corrective action when nonconforming work or departures from the policies and procedures in the quality system or technical operations have been identified. Both field and laboratory operations shall follow all corrective action requirements in methods and SOPs.

The following laboratory documentation is to be made accessible to the USACE Project Chemist. Corrective actions may be required, at the request of USACE, for the following conditions:

- Laboratory Procedures
- QC data outside the defined acceptance windows for precision or accuracy
- Blanks or Laboratory Control Samples (LCS) that contain contaminants above acceptable levels stated in the Data Quality Objectives
- Undesirable trends in spike or surrogate recoveries or RPD between spiked duplicates
- Unusual changes in method detection limits
- Deficiencies identified during internal or external audits or from the results of performance

The following corrective actions should be taken for common problems:

Incoming Samples - Problems noted during sample receipt are to be documented. The USACE Project Chemist is to be notified for problem resolution.

Sample Holding Times - If a maximum holding time is or may be exceeded by the laboratory, the USACE Project Chemist must be notified for problem resolution. The USACE Project Chemists may require re-sampling for the requested parameters.

Instrument Calibration - Sample analysis may not proceed until initial calibrations meet method criteria. Calibrations must meet method time requirements or recalibration must be performed. Continuing calibrations that do not meet accuracy criteria should result in a review of the calibration, rerun of the appropriate calibration standards, and reanalysis of samples affected back to the previous acceptable calibration check.

Limit of Quantitation (LOQ) - Appropriate sample clean-up procedures must be employed to attempt to achieve the practical quantitation limits as stated in the method. If difficulties arise in achieving these limits due to a particular sample matrix, the laboratory should notify the USACE Project Chemists of the problem for resolution. Dilutions are to be documented in the case narrative along with the revised practical quantitation limits for those analytes directly affected. Analytes detected above the method detection limits (MDLs) but below the practical limit(s) of quantitation are to be reported as estimated values and qualified "J".

Method Quality Control - Results related to method QC, including blank contamination, duplicate measurement reproducibility, MS/MSD recoveries, surrogate recoveries, LCS recoveries, and other method-specified QC measures are to meet the laboratory's SOPs and PQOs specified in this plan. Otherwise, the affected samples may be reanalyzed and/or re-extracted and reanalyzed within method-required holding times to verify the presence or absence of matrix effects. In order to confirm matrix effects, QC results must observe the same direction and magnitude (ten times) bias. The USACE Project Chemist should be notified as soon as possible to discuss appropriate corrective action.

Calculation Errors - Reports must be reissued if calculation and/or reporting errors are noted with any given data package. The case narrative is to state the reason(s) for re-issuance of a report.

4. DATA MANANGEMENT AND DOCUMENTATION

4.1. WP-QAPP

An electronic copy of the WP-QAPP (including appendices) will be stored in USACE project files and provided to the Technical Advisory Group.

4.2. Final Report

Upon completion of the sampling event and receipt/review of the validated data, USACE will prepare a final report. The report may be issued separately, or as an appendix to a future report that addresses source control. The report will include the following:

- Narrative and timeline of project activities
- Summary of sampling, chemical testing, and any deviations from the QAPP
- Analytical data summary and discussion
- Figures, tables, and appendices

The appendices will include field logs, laboratory analytical reports, data validation reports, and data summary tables with associated validation flags.

4.3. Laboratory Documentation (Data Package Deliverables)

4.3.1. Data Package Deliverables

The analytical data packages from the laboratories will be provided to the Project Chemist in sufficient detail for the required level of data validation. The analytical data packages will be validated to Stage 2a by the Project Chemist for 100% of all samples analyzed by the laboratory.

4.3.2. Electronic Data Reporting Formats

Laboratory data will be accepted as a report in PDF format. Additional electronic data deliverables (EDD) are not required.

5. DATA REVIEW, VERIFICATION, AND VALIDATION

Data review is the process by which data are examined and evaluated to varying levels of detail and specificity by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessment. This process ensures the review activities produce scientifically sound data that are of known and documented quality and meet PQOs used in making environmental decisions.

5.1. Review of Laboratory Data

All laboratory data packages will include raw data necessary for full validation. Analytical data packages will be validated to Stage 2a by the Project Chemist for 100% of all samples analyzed by the contracted laboratory.

Three distinct evaluative steps will be used to ensure that project-specific data quality needs are met:

- Data Verification (review for completeness) – Confirmation by examination and provision of objective evidence that the specified requirements (sampling and analytical) have been completed.

- Data Validation – Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Validation is a sampling and analytical process that includes evaluating compliance with method, procedure, or contract requirements and extends to evaluating against criteria based on the quality objectives developed in the QAPP (e.g., the QAPP measurement performance criteria). The purpose of validation is to assess the performance of the sampling and analysis processes to determine the quality of specified data. Data Validation Reports will be generated for each sampling event.

- Data Usability Assessment – Determination of the adequacy of data, based on the results of validation and verification, and professional judgment by the Project Chemist, for the decisions being made. The usability step involves assessing whether the process execution and resulting data meet project quality objectives documented in the QAPP.

Data review will be based on laboratory-specific SOPs conforming to the method and applying the principles of the Department of Defense Data Validation Guidelines (DoD, 2019b, 2020a, 2020b), and where applicable and not in conflict, the National Functional Guidelines for Superfund Data Review (USEPA, 2016, 2017a, 2017b). If significant deviations arise as a result of initial verification and validation, the level of review will be elevated in order to determine the source and impact of deviations.

5.2. Data Verification and Validation Stages

Data validation and verification stages described below are in accordance with the Department of Defense Data Validation Guidelines (DoD, 2019b) and Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA, 2009).

5.2.1. Stage 1

Verification and validation begins with Stage 1 checks of the laboratory analytical data package consisting of compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results (with associated information). The following minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 1 validation label:

(1) Documentation identifies the laboratory receiving and conducting analyses, and includes documentation for all samples submitted by the project or requested for analyses.

(2) Requested analytical methods were performed and the analysis dates are present.

(3) Requested target analyte results are reported along with the original laboratory data qualifiers and data qualifier definitions for each reported result (and the uncertainty of each result and clear indication of the type of uncertainty reported if required).

(4) Requested target analyte result units are reported.

(5) Requested reporting limits for all samples are present and results at and below the project-specific reporting limits are clearly identified (including sample detection limits if required).

(6) Sampling dates (including times if needed), date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH and temperature) are documented.

(7) Sample results are evaluated by comparing sample conditions upon receipt at the laboratory (e.g., preservation checks) and sample characteristics (e.g., percent moisture) to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

5.2.2. Stage 2A

Stage 2A validation builds on the validation conducted in Stage 1. Stage 2A validation of the laboratory analytical data package consists of the Stage 1 validation plus the verification and validation checks for the compliance of sample-related QC. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 2A Validation label:

(8) Requested methods (handling, preparation, cleanup, and analytical) are performed.

(9) Method dates (including dates, times and duration of analysis for radiation counting measurements and other methods, if needed) for handling (e.g., Toxicity Characteristic Leaching Procedure), preparation, cleanup and analysis are present, as appropriate.

(10) Sample-related QC data and QC acceptance criteria (e.g., method blanks, surrogate recoveries, deuterated monitoring compounds (DMC) recoveries, laboratory control sample (LCS) recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries) are provided and linked to the reported field samples (including the field quality control samples such as trip and equipment blanks).

(11) Requested spike analytes or compounds (e.g., surrogate, DMCs, LCS spikes) have been added, as appropriate.

(12) Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.

(13) Frequency of QC samples is checked for appropriateness (e.g., one LCS per twenty samples in a preparation batch).

(14) Sample results are evaluated by comparing holding times and sample-related QC data to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

5.2.3. Stage 2B

Stage 2B validation builds on the validation conducted in Stage 2A. Stage 2B validation of the laboratory analytical data package consists of the Stage 2A validation plus the verification and validation checks for the compliance of instrument-related QC. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 2B Validation label:

(15) Initial calibration data (e.g., initial calibration standards, initial calibration verification [ICV] standards, initial calibration blanks [ICBs]) are provided for all requested analytes and linked to field samples reported. For each initial calibration, the calibration type used is present along with the initial calibration equation used including any weighting factor(s) applied and the associated correlation coefficients, as appropriate. Recalculations of the standard concentrations using the initial calibration curve are present, along with their associated percent recoveries, as appropriate (e.g., if required by the project, method, or contract). For the ICV standard, the associated percent recovery (or percent difference, as appropriate) is present.

(16) Appropriate number and concentration of initial calibration standards are present.

(17) Continuing calibration data (e.g., continuing calibration verification [CCV] standards and continuing calibration blanks [CCBs]) are provided for all requested analytes and linked to field samples reported, as appropriate. For the CCV standard(s), the associated percent recoveries (or percent differences, as appropriate) are present.

(18) Reported samples are bracketed by CCV standards and CCBs standards as appropriate.

(19) Method specific instrument performance checks are present as appropriate (e.g., tunes for mass spectrometry methods).

(20) Frequency of instrument QC samples is checked for appropriateness (e.g., gas chromatography-mass spectroscopy [GC-MS] tunes have been run every 12 hours).

(21) Sample results are evaluated by comparing instrument-related QC data to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

5.2.4. Stage 3

Stage 3 validation builds on the validation conducted in Stage 2B. Stage 3 validation of the laboratory analytical data package consists of the Stage 2B validation plus the recalculation of instrument and sample results from the laboratory instrument responses, and comparison of recalculated results to laboratory reported results. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 3 Validation label:

(22) Instrument response data (e.g., GC peak areas) are reported for requested analytes, surrogates, internal standards, and DMCs for all requested field samples, matrix spikes, matrix spike duplicates, LCS, and method blanks as well as calibration data and instrument QC checks (e.g., tunes).

(23) Reported target analyte instrument responses are associated with appropriate internal standard analyte(s) for each (or selected) analyte(s) (for methods using internal standard for calibration).

(24) Fit and appropriateness of the initial calibration curve used or required (e.g., mean calibration factor, regression analysis [linear or non-linear, with or without weighting factors, with or without forcing]) is checked with recalculation of the initial calibration curve for each (or selected) analyte(s) from the instrument response.

(25) Comparison of instrument response to the minimum response requirements for each (or selected) analyte(s).

(26) Recalculation of each (or selected) opening and closing CCV (and CCB) response from the peak data reported for each (or selected) analyte(s) from the instrument response, as appropriate.

(27) Compliance check of recalculated opening and/or closing CCV (and CCB) response to recalculated initial calibration response for each (or selected) analyte(s).

(28) Recalculation of percent ratios for each (or selected) tune from the instrument response, as appropriate.

(29) Compliance check of recalculated percent ratio for each (or selected) tune from the instrument response.

(30) Recalculation of each (or selected) instrument performance check (e.g., instrument blanks,) from the instrument response.

(31) Recalculation and compliance check of retention time windows (for chromatographic methods) for each (or selected) analyte(s) from the laboratory reported retention times.

(32) Recalculation of reported results for each reported (or selected) target analyte(s) from the instrument response.

(33) Recalculation of each (or selected) reported spike recovery (surrogate recoveries, DMC recoveries, LCS recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries) from the instrument response.

(34) Each (or selected) sample result(s) and spike recovery(ies) are evaluated by comparing the recalculated numbers to the laboratory reported numbers according to the requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract.

Note: Selection of analytes, spikes, and performance evaluation checks for the Stage 3 validation checks for a laboratory analytical data package being verified and validated generally will depend on many factors including (but not limited to) the type of verification and validation being performed (manual or electronic), requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract, the number of laboratories reporting the data, the number and type of analytical methods reported, the number of analytes reported in each method, and the number of detected analytes.

5.2.5. Stage 4

Stage 4 validation builds on the validation conducted in Stage 3. Stage 4 validation of the laboratory analytical data package consists of the Stage 3 validation plus the evaluation of instrument outputs. The following additional minimum baseline checks (as relevant) shall be performed on the laboratory analytical data package received for a Stage 4 Validation label:

(35) All required instrument outputs (e.g., chromatograms, mass spectra) for evaluating sample and instrument performance are present.

(36) Sample results are evaluated by checking each (or selected) instrument output (e.g., chromatograms, mass spectra) for correct identification and quantitation of analytes (e.g., peak integrations, use of appropriate internal standards for quantitation, elution order of analytes, and interferences).

(37) Each (or selected) instrument's output(s) is evaluated for confirmation of non-detected or tentatively identified analytes.

Selection of instrument outputs for the Stage 4 validation checks for a laboratory analytical data package being verified and validated generally will depend on many factors including, but not limited to, the type of verification and validation being performed (electronic or manual), requirements and guidelines present in national or regional data validation documents, analytical method(s) or contract, the number of laboratories reporting the data, the number and type of analytical methods reported, the number of analytes reported in each method, and the number of detected analytes.

5.3. Data Verification and Validation Stages

A data validation report will be generated by the USACE Chemist that encompasses the results of the manual review of private lab data. The data validation report will be an appendix to the Final Report. Professional judgment shall be used when deciding if qualification of data is applicable. When professional judgment is applied, the rationale shall be provided. Tables of qualified data and the reasons for qualification will also be included in the data validation report.

Qualifiers will be added to data during the review as necessary. Qualifiers applied to the data as a result of the review are as follows:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit. The data are usable for decision-making purposes.

UJ Indicates the compound or analyte was analyzed for but not detected. Due to a quality control deficiency identified during data validation, the value reported may not accurately reflect the sample quantitation limit. The associated value is considered estimated, but the data are generally usable for decision-making purposes.

J Indicates the compound or analyte was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. False positives or false negatives are unlikely to have been reported and the data are generally usable for decision-making purposes.

J+ Data are qualified as estimated with a high bias. False positives are likely to occur but the data are generally usable for decision-making purposes.

J- Data are qualified as estimated with a low bias. False negatives are likely to occur but the data are generally usable for decision-making purposes.

X The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Note: It is possible that J-qualified data are not suitable for some purposes. For example, a J-qualified concentration with a low bias that is just below a screening value may not be usable to determine whether the analyte concentration is above or below the screening value. The effect of the use of qualified data on the decision-making process must be evaluated as part of the "reconciliation with user requirements" process.

5.4. Usability Assessment

The Project Chemist will evaluate overall precision, accuracy, completeness, representativeness, comparability, and sensitivity of the sampling data; including an assessment of the overall usability of the data and describing any limitations on its use. The Project Chemist will summarize any audit information, indicating corrective actions taken. This information will be part of the data validation report, which is an appendix to the Final Report.

6. REFERENCES

Department of Defense (DoD). 2019a. DoD Quality Systems Manual for Environmental Laboratories, Version 5.3, May 8.

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United Stated Environmental Protection Agency (USEPA). 2005. Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans Guidance, Part 1: UFP-QAPP Manual. March.

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Appendix A: Historic clam data 2007, 2008, 2011

Table 6-7b
Pre-Removal Clam Tissue Analytical Results
PCB Aroclors, Metals, and Semivolatile Organic Compounds

Area	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Forebay Pre-Sediment Removal	Selected SLV	SLV Source
Site ID	A1*	A2	A3	A5		
Sample ID	070926A1TC	070926A2TC	070927A3TC	070925A5TC		
Sample Date	9/26/2007	9/26/2007	9/27/2007	9/25/2007		
Percent Lipids	3.4	3.6	3.3	3.5		
PCB Aroclors (µg/kg wet)						
Aroclor 1016	2.40 U	2.40 U	2.40 U	4.70 U	35.0	Eco
Aroclor 1221	2.60 U	2.60 U	2.60 U	5.10 U	35.0	Eco
Aroclor 1232	2.30 U	2.30 U	2.30 U	4.50 U	35.0	Eco
Aroclor 1242	2.20 U	2.20 U	2.20 U	4.40 U	35.0	Eco
Aroclor 1248	0.510 U	0.510 U	0.510 U	1.00 U	35.0	Eco
Aroclor 1254	**355**	**250**	**180**	**120**	35.0	Eco
Aroclor 1260	1.90 U	1.90 U	1.90 U	3.80 U	35.0	Eco
Aroclor 1262	-	-	-	-	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	4.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**355 J**	**250 J**	**180 J**	**120 J**	35.0	Eco
Metals (mg/kg wet)						
Aluminum	**196**	**166**	**184**	**151**	--	--
Antimony	0.00500 U	0.00500 UJ	0.00500 U	0.00500 U	--	--
Arsenic	**2.56**	**3.03**	**3.13**	**2.56**	6.60	Eco
Barium	**2.51**	**2.68**	**2.25**	**2.07**	--	--
Beryllium	**0.00565**	**0.00420**	**0.00550**	**0.00360**	--	--
Cadmium	**0.438**	**0.454**	**0.426**	**0.340**	0.150	Eco
Chromium	**0.700**	**1.20**	**1.20**	**0.600**	--	--
Cobalt	**0.143**	**0.135**	**0.172**	**0.121**	--	--
Copper	**10.8**	**12.3**	**13.5**	**10.1**	--	--
Lead	**0.133**	**0.101**	**0.184**	**0.104**	0.120	Eco
Mercury	**0.0101**	**0.0114 J**	**0.0132**	**0.0114**	0.0740	Eco
Methyl Mercury	-	-	-	-	--	--
Nickel	**0.304**	**0.394**	**0.343**	**0.275**	--	--
Thallium	**0.0192**	**0.0159**	**0.0155**	**0.0162**	--	--
Vanadium	**0.493**	**0.416**	**0.540**	**0.391**	--	--
Zinc	**28.2**	**23.7**	**25.0**	**25.1**	--	--
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	66.0 U	66.0 U	66.0 U	-	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	-	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	-	--	--
Di-n-butyl Phthalate	**71.0 J**	16.0 U	**59.0 J**	-	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	-	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	-	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet						
Acenaphthene	**0.225 J**	**0.240 J**	**0.250 J**	-	19,000	Eco
Anthracene	**0.945**	**1.10 J**	**1.00**	-	19,000	Eco
Fluorene	**1.30**	**1.30**	**1.30**	-	19,000	Eco
Phenanthrene	**6.60**	**7.00**	**6.70**	-	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet						
Benzo(a)anthracene	**1.02**	**0.670**	**0.600**	-	1,000	Eco
Benzo(a)pyrene	0.0810 U	0.0810 U	0.0810 U	-	1,000	Eco
Benzo(b)fluoranthene	0.0700 U	0.0700 U	0.0700 U	-	1,000	Eco
Benzo(g,h,i)perylene	0.0730 U	0.0730 U	0.0730 U	-	1,000	Eco
Benzo(k)fluoranthene	0.0560 U	0.0560 U	0.0560 U	-	1,000	Eco
Chrysene	**2.55**	**2.50**	**2.10**	-	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	-	1,000	Eco
Fluoranthene	**12.5**	**12.0**	**12.0**	-	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	0.0640 U	0.0640 U	-	1,000	Eco
Pyrene	**2.80**	**2.80**	**2.70**	-	1,000	Eco

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available
J = The reported value is an estimate.

[1] Only Aroclor 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
U = The analyte was not detected at or above the MDL.
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL.
= The reported concentration exceeds the selected SLV
* = The data displayed are the result of averaging primary and field duplicate results at this sampling location as described in Section 5.1

Table 6-9a
Post-Removal Forebay Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P04	P05	P06	P07	P08	P09		
Sample ID	08022604TC	08031905TC	08031806TC	08021507TC	08021508TC	08021409TC		
Sample Date	2/26/2008	3/19/2008	3/18/2008	2/15/2008	2/15/2008	2/14/2008		
Percent Lipds	3.0	3.0	2.9	2.6	2.6	2.3		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	18.0 U	2.40 U	2.40 U	19.0 U	23.0 U	23.0 U	35.0	Eco
Aroclor 1221	20.0 U	2.60 U	2.60 U	20.0 U	20.0 U	20.0 U	35.0	Eco
Aroclor 1232	40.0 U	2.30 U	2.30 U	27.0 U	25.0 U	30.0 U	35.0	Eco
Aroclor 1242	48.0 U	2.20 U	2.20 U	35.0 U	29.0 U	30.0 U	35.0	Eco
Aroclor 1248	0.510 U	0.510 U	0.510 U	26.0 U	13.0 U	6.00 U	35.0	Eco
Aroclor 1254	**120 J**	**23.0 J**	**32.0 J**	74.0 U	55.0 U	49.0 U	35.0	Eco
Aroclor 1260	1.90 U	1.90 U	1.90 U	11.0 U	9.40 U	8.50 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	**120 J**	**23.0 J**	**32.0 J**	74.0 U	55.0 U	49.0 U	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)								
PCB 77	**0.0690**	**0.0410**	**0.0523**	**0.0359**	**0.0348**	-	0.160	Eco
PCB 81	0.00330 EMPC	0.00270 EMPC	0.00197 EMPC	0.00156 EMPC	0.00142 EMPC	-	0.0800	Eco
PCB 105	**6.20**	**1.02**	**1.73**	**0.924**	**0.741**	-	20.0	Eco
PCB 114	**0.445**	**0.0774**	**0.126**	**0.0655**	**0.0525**	-	20.0	Eco
PCB 118	**64.7**	**10.3**	**15.9**	**12.1**	**7.97**	-	20.0	Eco
PCB 123	**1.15**	**0.239**	**0.293**	**0.229**	**0.152**	-	20.0	Eco
PCB 126	**0.0110**	**0.00527**	**0.00574**	**0.00457**	**0.00417**	-	0.00580	Eco
PCB 156	**3.61 C**	**0.614 C**	**0.828 C**	**0.584 C**	**0.405 C**	-	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						20.0	Eco
PCB 167	**3.80**	**0.956**	**1.18**	**0.944**	**0.566**	-	20.0	Eco
PCB 169	0.0165 U	0.00173 U	0.00660 U	0.00560 U	0.00473 U	-	0.0200	Eco
PCB 189	**0.0101**	**0.00277**	**0.00403**	**0.00222**	**0.00212**	-	20.0	Eco
Total PCBs as Congeners (KM, capped)	**312 J**	**65.8 J**	**95.1 J**	**65.7 J**	**51.5 J**	-	35.0	Eco
Metals (mg/kg wet)								
Aluminum	**61.1**	**13.2**	**10.9**	**21.9**	**21.7**	**76.8**	--	--
Antimony	0.00200 U	0.00400 U	0.00400 U	0.00200 U	**0.00700 J**	**0.00200 J**	--	--
Arsenic	**2.48**	**2.44**	**2.26**	**2.38**	**2.24**	**2.12**	6.60	Eco
Barium	**2.14**	**1.23**	**1.35**	**2.23**	**1.62**	**2.45**	--	--
Beryllium	**0.00240 J**	**0.00100 J**	**0.00100 J**	**0.00170 J**	**0.00230 J**	**0.00280 J**	--	--
Cadmium	**0.369**	**0.383**	**0.406**	**0.377**	**0.351**	**0.305**	0.150	Eco
Chromium	**0.700**	**0.380**	**0.340**	**0.900**	**0.800**	**0.700**	--	--
Cobalt	**0.133**	**0.0790**	**0.0700**	**0.117**	**0.0970**	**0.148**	--	--
Copper	**10.4**	**9.63**	**9.45**	**9.80**	**9.36**	**8.36**	--	--
Lead	**0.0570**	**0.0260**	**0.0280**	**0.0330**	**0.0310**	**0.0890**	0.120	Eco
Mercury	**0.0160**	**0.00780**	**0.00660**	**0.00850**	**0.00710**	**0.0341**	0.0740	Eco
Methyl Mercury	**0.00460**	**0.00480**	**0.00490**	**0.00410**	**0.00350**	**0.00480**	--	--
Nickel	**0.281**	**0.114**	**0.117**	**0.306**	**0.263**	**0.336**	--	--
Thallium	**0.00660**	**0.00720**	**0.00970**	**0.00570**	**0.0119**	**0.00630**	--	--
Vanadium	**0.301**	**0.0810**	**0.0850**	**0.117**	**0.141**	**0.314**	--	--
Zinc	**26.5**	**19.8**	**19.9**	**20.6**	**18.0**	**22.3**	--	--
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	**150 J**	**670**	**740**	**130 J**	**130 J**	**150 J**	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	**14.0 J**	7.30 U	7.30 U	7.30 U	11.0 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	13.0 U	--	--
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	56.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	16.0 U	626	Eco
p-cresol (4-Methylphenol)	**25.0 J**	**18.0 J**	**14.0 J**	**20.0 J**	**10.0 J**	11.0 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	**0.990**	**1.10**	**1.10 J**	**1.10**	**0.910**	**0.940**	19,000	Eco
Anthracene	0.0650 U	**0.960 J**	**1.00 J**	0.0650 U	**0.990**	**0.280 J**	19,000	Eco
Fluorene	**2.30**	**3.00**	**2.80 J**	**2.50**	**2.40**	**2.00**	19,000	Eco
Phenanthrene	**9.10**	**8.90**	**9.60 J**	**12.0**	**11.0**	**9.80**	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	0.0660 U	12.0 U	15.0 U	0.0660 U	**0.800**	**1.20**	1,000	Eco
Benzo(a)pyrene	0.0810 U	0.410 U	0.410 U	0.0810 U	**0.440 J**	0.610 U	1,000	Eco
Benzo(b)fluoranthene	0.0700 U	0.350 U	0.350 U	0.800 U	**0.530**	**0.950**	1,000	Eco
Benzo(g,h,i)perylene	**0.300 J**	0.370 U	0.370 U	0.0730 U	**0.0900 J**	**0.360 J**	1,000	Eco
Benzo(k)fluoranthene	0.0560 U	0.280 U	0.280 U	0.0560 U	0.0560 U	0.0560 U	1,000	Eco
Chrysene	0.0760 U	5.60 U	6.60 U	0.0760 U	**3.00**	**4.00**	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.300 U	0.300 U	0.0590 U	0.0590 U	0.0590 U	1,000	Eco
Fluoranthene	**11.0**	**11.0**	**12.0 J**	16.0 U	**12.0**	11.0 U	19,000	Eco
Indeno(1,2,3-cd)pyrene	**2.50**	0.320 U	0.320 U	0.0640 U	**0.0900 J**	**0.320 J**	1,000	Eco
Pyrene	0.0980 U	4.90 U	5.30 U	0.0980 U	**1.70**	2.30 U	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
= The reported concentration exceeds the selected SLV

Table 6-9a
Post-Removal Forebay Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P10	P11	P13	P14	P15	P16		
Sample ID	08021410TC	08021411TC	08031713TC	08031814TC	08022115TC	08022116TC		
Sample Date	2/14/2008	2/14/2008	3/17/2008	3/18/2008	2/21/2008	2/21/2008		
Percent Lipds	2.0	2.6	2.7	2.8	2.6	2.3		
PCB Aroclors (µg/kg wet)								
Aroclor 1016	23.0 U	21.0 U	2.40 U	2.40 U	19.0 U	17.0 U	35.0	Eco
Aroclor 1221	20.0 U	20.0 U	2.60 U	2.60 U	20.0 U	20.0 U	35.0	Eco
Aroclor 1232	34.0 U	36.0 U	2.30 U	2.30 U	35.0 U	30.0 U	35.0	Eco
Aroclor 1242	19.0 U	19.0 U	2.20 U	2.20 U	17.0 U	15.0 U	35.0	Eco
Aroclor 1248	12.0 U	9.90 U	0.510 U	0.510 U	4.60 U	4.50 U	35.0	Eco
Aroclor 1254	36.0 U	32.0 U	**22.0**	**22.0**	32.0 U	30.0 U	35.0	Eco
Aroclor 1260	6.90 U	6.40 U	1.90 U	1.90 U	6.70 U	6.80 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	36.0 U	32.0 U	**22.0**	**22.0**	32.0 U	30.0 U	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)								
PCB 77	**0.0269**	**0.0336**	**0.0375**	**0.0388**	**0.0333**	**0.0301**	0.160	Eco
PCB 81	0.000693 EMPC	0.00142 EMPC	**0.00194**	0.00208 EMPC	0.00131 EMPC	0.00154 EMPC	0.0800	Eco
PCB 105	**0.455**	**0.407**	**0.437**	**0.464**	**0.397**	**0.361**	20.0	Eco
PCB 114	**0.0281**	**0.0238**	**0.0260**	**0.0274**	**0.0231**	**0.0209**	20.0	Eco
PCB 118	**4.09**	**2.26**	**2.73**	**2.87**	**2.30**	**2.17**	20.0	Eco
PCB 123	**0.0837**	**0.0462**	**0.0512**	**0.0595**	**0.0471**	**0.0420**	20.0	Eco
PCB 126	**0.00337**	**0.00413**	**0.00506**	**0.00531**	**0.00386**	**0.00402**	0.00580	Eco
PCB 156	**0.228 C**	**0.136 C**	**0.157 C**	**0.171 C**	**0.133 C**	**0.128 C**	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**						20.0	Eco
PCB 167	**0.302**	**0.146**	**0.209**	**0.213**	**0.157**	**0.149**	20.0	Eco
PCB 169	0.00337 U	0.00327 U	0.00135 U	0.00109 U	0.00356 U	0.00353 U	0.0200	Eco
PCB 189	**0.00152**	**0.00171**	**0.00166**	**0.00203**	**0.00156**	**0.00156**	20.0	Eco
Total PCBs as Congeners (KM, capped)	**30.6 J**	**26.7 J**	**33.1 J**	**34.0 J**	**26.9 J**	**25.5 J**	35.0	Eco
Metals (mg/kg wet)								
Aluminum	**81.4**	**33.7**	**9.53**	**9.42**	**18.7**	**15.9**	--	--
Antimony	**0.00200 J**	0.00200 U	0.00400 U	0.00400 U	0.00200 U	0.00200 U	--	--
Arsenic	**1.79**	**2.04**	**2.49**	**2.47**	**2.43**	**2.11**	6.60	Eco
Barium	**2.22**	**2.04**	**1.74**	**1.18**	**1.77**	**1.63**	--	--
Beryllium	**0.00270 J**	**0.00190 J**	**0.00150 J**	**0.00170 J**	**0.00160 J**	**0.00140 J**	--	--
Cadmium	**0.286**	**0.321**	**0.461**	**0.442**	**0.366**	**0.321**	0.150	Eco
Chromium	**0.600**	**0.700**	**0.560**	**0.390**	**0.900**	**0.600**	--	--
Cobalt	**0.140**	**0.135**	**0.0980**	**0.0720**	**0.120**	**0.104**	--	--
Copper	**7.00**	**7.95**	**11.4**	**9.72**	**10.4**	**8.67**	--	--
Lead	**0.0610**	**0.0510**	**0.0290**	**0.0290**	**0.0370**	**0.0350**	0.120	Eco
Mercury	**0.00870**	**0.0108**	**0.00720**	**0.0169**	**0.0132**	**0.0103**	0.0740	Eco
Methyl Mercury	**0.00500**	**0.00500**	**0.00530**	**0.00650**	**0.00530**	**0.00480**	--	--
Nickel	**0.348**	**0.320**	**0.136**	**0.0950**	**0.242**	**0.222**	--	--
Thallium	**0.00500**	**0.00570**	**0.00710**	**0.00720**	**0.00580**	**0.00470**	--	--
Vanadium	**0.311**	**0.196**	**0.0850**	**0.0930**	**0.136**	**0.175**	--	--
Zinc	**22.9**	**23.5**	**17.8**	**16.3**	**20.8**	**17.7**	--	--
Semivolatile Organic Compounds (µg/kg wet)								
Bis(2-ethylhexyl) Phthalate	**97.0 J**	**120 J**	**890**	**720**	**180 J**	**130 J**	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	**13.0 J**	7.30 U	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	--	--
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	**38.0 J**	11.0 U	11.0 U	626	Eco
p-cresol (4-Methylphenol)	7.70 U	**14.0 J**	**8.60 J**	7.70 U	7.70 U	7.70 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)								
Acenaphthene	**0.800**	**0.970**	**4.10**	**0.840**	**1.00 J**	**0.820**	19,000	Eco
Anthracene	**0.440 J**	**0.850**	**2.30 J**	**1.10 J**	**0.940 J**	**0.980**	19,000	Eco
Fluorene	**1.60**	**2.30**	**3.80**	**2.70**	**2.50 J**	**2.00**	19,000	Eco
Phenanthrene	**6.70**	**12.0**	**15.0**	**9.60**	**13.0 J**	**8.00**	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)								
Benzo(a)anthracene	**0.480 J**	**2.10**	22.0 U	15.0 U	0.0660 UJ	**0.990**	1,000	Eco
Benzo(a)pyrene	0.0810 U	**0.580**	0.410 U	0.410 U	0.0810 UJ	0.0810 U	1,000	Eco
Benzo(b)fluoranthene	**0.400 J**	**0.810**	0.350 U	0.350 U	**0.780 J**	**0.600**	1,000	Eco
Benzo(g,h,i)perylene	0.0730 U	**0.120 J**	2.50 U	0.370 U	**0.240 J**	**0.270 J**	1,000	Eco
Benzo(k)fluoranthene	**0.160 J**	0.0560 U	0.280 U	0.280 U	0.0560 UJ	0.0560 U	1,000	Eco
Chrysene	**2.90**	**3.00**	6.70 U	7.80 U	0.0760 UJ	**3.20**	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.300 U	0.300 U	0.0590 UJ	0.0590 U	1,000	Eco
Fluoranthene	**8.90**	**13.0**	**14.0**	**12.0**	**6.30 J**	**11.0**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	**0.0800 J**	0.320 U	0.320 U	0.0640 UJ	**0.400 J**	1,000	Eco
Pyrene	**2.40**	**2.20**	7.20 U	4.60 U	**3.60 J**	**1.60**	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
= The reported concentration exceeds the selected SLV

Table 6-9a
Post-Removal Forebay Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P17	P18	P21	P65	P67	P88	P89		
Sample ID	08022117TC	08021118TC	08021221TC	08022965TC	08030367TC	08031788TC	08031789TC		
Sample Date	2/21/2008	2/12/2008	2/12/2008	2/29/2008	3/3/2008	3/17/2008	3/17/2008		
Percent Lipds	2.2	2.4	2.4	3.3	3.7	2.8	2.6		
PCB Aroclors (µg/kg wet)									
Aroclor 1016	17.0 U	17.0 U	15.0 U	2.40 U	2.40 U	2.40 U	2.40 U	35.0	Eco
Aroclor 1221	20.0 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	2.60 U	35.0	Eco
Aroclor 1232	31.0 U	23.0 U	19.0 U	2.30 U	2.30 U	2.30 U	2.30 U	35.0	Eco
Aroclor 1242	15.0 U	22.0 U	10.0 U	2.20 U	2.20 U	2.20 U	2.20 U	35.0	Eco
Aroclor 1248	9.20 U	9.90 U	4.60 U	0.510 U	0.510 U	0.510 U	0.510 U	35.0	Eco
Aroclor 1254	28.0 U	28.0 U	30.0 U	**21.0**	**21.0**	**23.0**	**21.0**	35.0	Eco
Aroclor 1260	5.90 U	5.90 U	6.20 U	1.90 U	1.90 U	1.90 U	1.90 U	35.0	Eco
Aroclor 1262	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	2.50 U	35.0	Eco
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	35.0	Eco
Total PCBs as Aroclors (NDs at MDL) [1]	28.0 U	28.0 U	30.0 U	**21.0**	**21.0**	**23.0**	**21.0**	35.0	Eco
PCB Dioxin-Like Congeners (µg/kg wet)									
PCB 77	**0.0307**	**0.0339**	**0.0320**	**0.0420**	-	**0.0398**	**0.0359**	0.160	Eco
PCB 81	0.00155 EMPC	0.00142 EMPC	0.00138 EMPC	**0.00246**	-	**0.00201**	**0.00238**	0.0800	Eco
PCB 105	**0.365**	**0.377**	**0.371**	**0.478**	-	**0.476**	**0.444**	20.0	Eco
PCB 114	**0.0202**	**0.0228**	**0.0216**	**0.0291**	-	**0.0287**	**0.0273**	20.0	Eco
PCB 118	**2.08**	**2.13**	**2.05**	**2.54**	-	**2.76**	**2.67**	20.0	Eco
PCB 123	**0.0384**	**0.0413**	**0.0392**	**0.0438**	-	**0.0520**	**0.0544**	20.0	Eco
PCB 126	**0.00339**	**0.00363**	**0.00400**	**0.00530**	-	**0.00510**	**0.00472**	0.00580	Eco
PCB 156	**0.120 C**	**0.124 C**	**0.121 C**	**0.156 C**	-	**0.168 C**	**0.158 C**	20.0	Eco
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**							20.0	Eco
PCB 167	**0.134**	**0.131**	**0.125**	**0.154**	-	**0.185**	**0.201**	20.0	Eco
PCB 169	0.00340 U	0.00366 U	0.00362 U	0.000940 U	-	0.000901 U	0.00110 U	0.0200	Eco
PCB 189	**0.00167**	**0.00160**	**0.00166**	**0.00221**	-	**0.00218**	**0.00181**	20.0	Eco
Total PCBs as Congeners (KM, capped)	**24.5 J**	**25.9 J**	**24.6 J**	**33.1 J**	-	**33.2 J**	**31.6 J**	35.0	Eco
Metals (mg/kg wet)									
Aluminum	**35.2**	**34.5**	**49.2**	**83.2**	**15.2**	**9.37**	**18.9**	--	--
Antimony	**0.00300 J**	0.00200 U	**0.00400 J**	0.00400 U	0.00500 U	0.00400 U	0.00400 U	--	--
Arsenic	**1.88**	**1.88**	**2.07**	**2.31**	**2.15**	**2.34**	**2.38**	6.60	Eco
Barium	**1.76**	**2.05**	**2.29**	**3.05**	**1.64**	**1.49**	**1.62**	--	--
Beryllium	**0.00210 J**	**0.00180 J**	**0.00250 J**	**0.00380 J**	**0.00120 J**	**0.000700 J**	**0.00170 J**	--	--
Cadmium	**0.287**	**0.342**	**0.313**	**0.355**	**0.396**	**0.396**	**0.412**	0.150	Eco
Chromium	**0.600**	**0.700**	**0.800**	**0.480**	**0.300**	**0.330**	**0.530**	--	--
Cobalt	**0.115**	**0.110**	**0.124**	**0.138**	**0.0720**	**0.0670**	**0.0840**	--	--
Copper	**8.00**	**8.31**	**8.29**	**9.56**	**9.00**	**8.86**	**9.61**	--	--
Lead	**0.0370**	**0.0580**	**0.0580**	**0.0800**	**0.0330**	**0.0210**	**0.0260**	0.120	Eco
Mercury	**0.0116**	**0.0102**	**0.00770**	**0.00880**	**0.00860**	**0.0101**	**0.00580**	0.0740	Eco
Methyl Mercury	**0.00400**	**0.00510**	**0.00360**	**0.00480**	**0.00630**	**0.00430**	**0.00360**	--	--
Nickel	**0.238**	**0.303**	**0.324**	**0.227**	**0.144**	**0.126**	**0.178**	--	--
Thallium	**0.00450**	**0.00600**	**0.00590**	**0.00850**	**0.00950**	**0.00710**	**0.00700**	--	--
Vanadium	**0.205**	**0.207**	**0.204**	**0.426**	**0.104**	**0.0780**	**0.107**	--	--
Zinc	**20.2**	**25.1**	**23.5**	**25.0**	**24.3**	**20.4**	**21.6**	--	--
Semivolatile Organic Compounds (µg/kg wet)									
Bis(2-ethylhexyl) Phthalate	**67.0 J**	**130 J**	**110 J**	**760**	**830**	**710**	**750 J**	1,760	Eco
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	7.30 U	7.30 U	**15.0 J**	7.30 U	310	Eco
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	--	--
Di-n-butyl Phthalate	16.0 U	16.0 U	40.0 U	16.0 U	16.0 U	16.0 U	16.0 UJ	626	Eco
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 UJ	626	Eco
p-cresol (4-Methylphenol)	7.70 U	7.70 U	7.70 U	**31.0 J**	**8.60 J**	**9.30 J**	7.70 U	--	--
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)									
Acenaphthene	**0.670**	**0.910**	**0.980**	**0.420 J**	0.110 U	**0.460 J**	**1.10**	19,000	Eco
Anthracene	**0.460 J**	**1.20**	**0.790**	0.330 U	0.330 U	**0.800 J**	**1.50**	19,000	Eco
Fluorene	**1.60**	**2.20**	**2.10**	**1.70**	**0.920**	**1.50 J**	**2.90**	19,000	Eco
Phenanthrene	**6.90**	**9.70**	**8.50**	**7.90**	**4.50**	**5.30 J**	**12.0**	19,000	Eco
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)									
Benzo(a)anthracene	**0.680**	**1.30**	**0.970**	0.330 U	0.330 U	17.0 UJ	1.30 U	1,000	Eco
Benzo(a)pyrene	0.0810 U	0.620 U	**0.380 J**	0.410 U	0.410 U	0.410 UJ	0.860 U	1,000	Eco
Benzo(b)fluoranthene	**0.710**	**0.640**	**0.550**	0.350 U	0.350 U	0.350 UJ	0.740 U	1,000	Eco
Benzo(g,h,i)perylene	0.0730 U	**0.130 J**	**0.130 J**	0.370 U	0.370 U	0.370 UJ	0.500 U	1,000	Eco
Benzo(k)fluoranthene	0.0560 U	**0.250 J**	0.0560 U	0.280 U	0.280 U	0.280 UJ	0.580 U	1,000	Eco
Chrysene	**2.60**	**1.90**	**3.70**	0.380 U	0.380 U	6.50 UJ	2.50 U	1,000	Eco
Dibenz(a,h)anthracene	0.0590 U	0.0590 U	0.0590 U	0.300 U	0.300 U	0.300 UJ	0.500 U	1,000	Eco
Fluoranthene	**9.40**	14.0 U	**11.0**	14.0 U	8.60 U	**7.60 J**	**16.0**	19,000	Eco
Indeno(1,2,3-cd)pyrene	0.0640 U	**0.0850 J**	0.0640 U	0.320 U	0.320 U	0.320 UJ	0.500 U	1,000	Eco
Pyrene	**2.90**	2.90 U	1.50 U	0.490 U	0.490 U	4.00 UJ	**6.30**	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological
HH = Human Health
MDL = method detection limit
SLV = screening level value
RDL = reported detection limit
- = Not Analyzed
-- = SLV for analyte not available
ND = Non Detect

[1] Only Aroclor 1254 was included in summing Total PCBs as Aroclors because all other aroclors were undected in Forebay clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
bold = analyte detected above MDL/RDL.
= The reported concentration exceeds the selected SLV

Table 6-9b
Post-Removal Reference Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 1 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P22	P24	P26	P27	P28	P29
Sample ID	08030522TC	08030524TC	08030426TC	08030427TC	08030428TC	08022229TC
Sample Date	3/5/2008	3/5/2008	3/4/2008	3/4/2008	3/4/2008	2/22/2008
Percent Lipds	2.9	2.6	3.0	3.1	2.7	3.0
PCB Aroclors (µg/kg wet)						
Aroclor 1016	13.0 U	11.0 U	11.0 U	12.0 U	8.90 U	13.0 U
Aroclor 1221	14.0 U	14.0 U	14.0 U	8.20 U	9.60 U	16.0 U
Aroclor 1232	19.0 U	18.0 U	22.0 U	27.0 U	18.0 U	26.0 U
Aroclor 1242	13.0 U	7.90 U	11.0 U	12.0 U	12.0 U	13.0 U
Aroclor 1248	5.70 U	5.70 U	7.60 U	8.30 U	5.70 U	7.70 U
Aroclor 1254	**36.0**	**30.0**	**35.0**	**37.0**	**33.0**	**32.0**
Aroclor 1260	6.40 U	6.20 U	6.50 U	6.80 U	6.60 U	5.70 U
Aroclor 1262	9.30 U	7.20 U	7.70 U	7.80 U	7.50 U	8.00 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**36.0**	**30.0**	**35.0**	**37.0**	**33.0**	**32.0**
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.0378**	**0.0338**	**0.0332**	**0.0343**	**0.0373**	**0.0364**
PCB 81	**0.00189**	**0.00204**	0.00143 EMPC	0.000961 EMPC	**0.00211**	**0.00207**
PCB 105	**0.438**	**0.399**	**0.350**	**0.370**	**0.434**	**0.406**
PCB 114	**0.0267**	**0.0228**	**0.0213**	**0.0242**	**0.0258**	**0.0236**
PCB 118	**2.42**	**2.22**	**1.91**	**2.13**	**2.66**	**2.14**
PCB 123	**0.0484**	**0.0423**	**0.0390**	**0.0421**	**0.0540**	**0.0403**
PCB 126	**0.00501**	**0.00444**	**0.00407**	**0.00451**	**0.00504**	**0.00405**
PCB 156	**0.138 C**	**0.126 C**	**0.137 C**	**0.149 C**	**0.152 C**	**0.125 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.149**	**0.127**	**0.151**	**0.167**	**0.170**	**0.130**
PCB 169	0.000809 U	0.000933 U	0.00153 U	0.00170 U	0.000872 U	0.000900 U
PCB 189	**0.00183**	**0.00175**	**0.00144**	0.00151 EMPC	**0.00185**	**0.00168**
Total PCBs as Congeners (KM, capped)	**30.8 J**	**28.3 J**	**31.6 J**	**32.9 J**	**31.3 J**	**29.7 J**
Metals (mg/kg wet)						
Aluminum	**34.3**	**50.4**	**46.5**	**52.2**	**39.8**	**16.8**
Antimony	**0.00500**	0.00400 U	0.00400 U	0.00400 U	0.00400 U	0.00400 U
Arsenic	**2.53**	**2.03**	**2.51**	**2.46**	**2.32**	**2.22**
Barium	**1.79**	**2.11**	**1.77**	**1.80**	**2.17**	**1.89**
Beryllium	0.000400 U	**0.000900**	**0.00110**	0.000400 U	**0.000900**	0.000400 U
Cadmium	**0.307**	**0.275**	**0.377**	**0.370**	**0.340**	**0.254**
Chromium	**0.510**	**0.600**	**0.730**	**0.690**	**0.660**	**0.480**
Cobalt	**0.132**	**0.132**	**0.124**	**0.141**	**0.150**	**0.116**
Copper	**9.67**	**8.91**	**10.7**	**10.7**	**10.4**	**8.46**
Lead	**0.0660**	**0.0570**	**0.0570**	**0.0590**	**0.0570**	**0.0690**
Mercury	**0.0179**	**0.00600**	**0.0128**	**0.00890**	**0.0130**	**0.00760**
Methyl Mercury	**0.00990**	**0.00470**	**0.00490**	**0.00470**	**0.00520**	**0.00780**
Nickel	**0.311**	**0.405**	**0.338**	**0.347**	**0.347**	**0.408**
Thallium	**0.00590**	**0.00530**	**0.00650**	**0.00630**	**0.00560**	**0.00560**
Vanadium	**0.169**	**0.170**	**0.172**	**0.182**	**0.150**	**0.135**
Zinc	**18.7**	**19.9**	**21.0**	**20.2**	**19.4**	**19.8**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	**310**	**320**	**430**	**680**	**340**	**680**
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	**57.0 J**	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	**44.0**	**52.0**	**18.0 J**	**42.0**	**55.0**	**63.0**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.710**	**0.480 J**	**0.730**	**0.450 J**	**0.510**	**1.20 J**
Anthracene	1.40 U	3.20 U	1.40 U	1.30 UJ	3.20 U	**1.80 J**
Fluorene	**2.00**	**1.50**	**2.00**	**1.60 J**	**1.50**	**3.10 J**
Phenanthrene	**9.10**	**6.70**	**9.00**	**8.10 J**	**7.50**	**14.0 J**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	18.0 U	3.70 U	26.0 U	15.0 UJ	7.30 U	12.0 UJ
Benzo(a)pyrene	0.410 U	0.410 U	0.410 U	0.410 UJ	0.410 U	0.410 UJ
Benzo(b)fluoranthene	0.350 U	0.350 U	0.350 U	0.350 UJ	0.350 U	0.350 UJ
Benzo(g,h,i)perylene	0.370 U	0.370 U	0.370 U	0.370 UJ	0.370 U	0.370 UJ
Benzo(k)fluoranthene	0.280 U	0.280 U	0.280 U	0.280 UJ	0.280 U	0.280 UJ
Chrysene	5.50 U	5.30 U	5.30 U	13.0 UJ	6.30 U	1.30 UJ
Dibenz(a,h)anthracene	0.300 U	0.300 U	0.300 U	0.300 UJ	0.300 U	0.300 UJ
Fluoranthene	**11.0**	**8.50**	**11.0**	**10.0 J**	**9.30**	**17.0 J**
Indeno(1,2,3-cd)pyrene	0.320 U	**1.70 J**	0.320 U	0.320 UJ	0.320 U	0.320 UJ
Pyrene	3.70 U	2.00 U	4.10 U	2.80 UJ	2.40 U	5.60 UJ

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclors 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Reference Area clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-9b
Post-Removal Reference Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 2 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P34	P35	P36	P37	P38	P39
Sample ID	08022534TC	08022535TC	08022536TC	08022637TC	08022738TC	08022739TC
Sample Date	2/25/2008	2/25/2008	2/25/2008	2/26/2008	2/27/2008	2/27/2008
Percent Lipds	2.8	3.6	3.5	3.1	3.2	3.2
PCB Aroclors (µg/kg wet)						
Aroclor 1016	12.0 U	9.50 U	8.40 U	9.70 U	15.0 U	15.0 U
Aroclor 1221	15.0 U	8.80 U	12.0 U	16.0 U	6.30 U	7.40 U
Aroclor 1232	23.0 U	28.0 U	19.0 U	29.0 U	35.0 U	33.0 U
Aroclor 1242	13.0 U	14.0 U	13.0 U	9.30 U	12.0 U	11.0 U
Aroclor 1248	6.40 U	9.10 U	9.90 U	9.90 U	9.40 U	9.60 U
Aroclor 1254	**32.0**	**37.0**	**38.0**	**35.0**	**37.0**	**38.0**
Aroclor 1260	5.90 U	7.70 U	7.60 U	7.30 U	8.10 U	7.50 U
Aroclor 1262	8.10 U	8.10 U	7.70 U	3.70 U	7.60 U	9.10 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**32.0**	**37.0**	**38.0**	**35.0**	**37.0**	**38.0**
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.0361**	**0.0428**	**0.0443**	**0.0384**	**0.0371**	**0.0432**
PCB 81	0.00223 EMPC	**0.00260**	**0.00251**	0.00167 EMPC	0.00199 EMPC	0.00213 EMPC
PCB 105	**0.424**	**0.484**	**0.484**	**0.419**	**0.416**	**0.484**
PCB 114	**0.0246**	**0.0299**	**0.0272**	**0.0240**	**0.0233**	**0.0287**
PCB 118	**2.20**	**2.47**	**2.42**	**2.18**	**2.14**	**2.52**
PCB 123	**0.0384**	**0.0461**	**0.0439**	**0.0418**	**0.0368**	**0.0469**
PCB 126	**0.00403**	**0.00535**	**0.00519**	**0.00464**	**0.00474**	**0.00533**
PCB 156	**0.129 C**	**0.148 C**	**0.154 C**	**0.138 C**	**0.135 C**	**0.166 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.127**	**0.139**	**0.139**	**0.146**	**0.123**	**0.154**
PCB 169	0.000939 U	0.000901 U	0.00132 U	0.000698 U	0.000987 U	0.00101 U
PCB 189	**0.00198**	**0.00223**	**0.00240**	**0.00209**	**0.00195**	**0.00234**
Total PCBs as Congeners (KM, capped)	**30.4 J**	**34.5 J**	**33.7 J**	**30.2 J**	**28.6 J**	**34.3 J**
Metals (mg/kg wet)						
Aluminum	**29.2**	**12.0**	**17.1**	**14.5**	**20.6**	**19.9**
Antimony	**0.00400**	0.00500 U	0.00400 U	0.00400 U	0.00400 U	0.00400 U
Arsenic	**2.00**	**2.28**	**2.38**	**2.22**	**2.24**	**2.46**
Barium	**1.78**	**1.79**	**1.72**	**1.83**	**1.71**	**1.97**
Beryllium	**0.000400**	**0.000700**	0.000400 U	**0.000500**	0.000400 U	**0.000900**
Cadmium	**0.247**	**0.308**	**0.356**	**0.320**	**0.335**	**0.385**
Chromium	**0.490**	**0.450**	**0.470**	**0.540**	**0.460**	**0.570**
Cobalt	**0.121**	**0.100**	**0.0969**	**0.106**	**0.0974**	**0.104**
Copper	**8.18**	**9.57**	**9.61**	**10.1**	**9.50**	**10.4**
Lead	**0.0670**	**0.0660**	**0.0650**	**0.0650**	**0.0670**	**0.0670**
Mercury	**0.00850**	**0.0121**	**0.00610**	**0.00460**	**0.0113**	**0.00630**
Methyl Mercury	**0.00750**	**0.00610**	**0.00590**	**0.00610**	**0.00590**	**0.00610**
Nickel	**0.324**	**0.392**	**0.389**	**0.359**	**0.289**	**0.341**
Thallium	**0.00630**	**0.00820**	**0.00740**	**0.00640**	**0.00810**	**0.00660**
Vanadium	**0.188**	**0.0860**	**0.104**	**0.124**	**0.171**	**0.138**
Zinc	**20.5**	**22.9**	**23.2**	**20.3**	**21.7**	**23.0**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	**440**	**510**	**510**	**400**	**480**	**350**
Butyl Benzyl Phthalate	7.30 U	7.30 U	7.30 U	**74.0 J**	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U	16.0 U
Di-n-octyl Phthalate	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	**20.0 J**	**45.0**	**72.0**	**110**	**36.0 J**	**52.0**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.610**	**0.650**	**1.00**	**0.910**	**0.530 J**	**0.590**
Anthracene	1.50 U	1.90 U	1.90 U	2.00 U	1.40 UJ	1.60 U
Fluorene	**1.90**	**2.40**	**2.70**	**2.70**	**1.90 J**	**2.10**
Phenanthrene	**9.40**	**12.0**	**12.0**	**13.0**	**9.30 J**	**10.0**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	16.0 U	22.0 U	26.0 U	27.0 U	20.0 UJ	27.0 U
Benzo(a)pyrene	0.410 U	0.410 U	0.410 U	0.410 U	0.410 UJ	0.410 U
Benzo(b)fluoranthene	0.350 U	0.350 U	0.350 U	0.350 U	0.350 UJ	0.350 U
Benzo(g,h,i)perylene	0.370 U	**0.500 J**	0.370 U	0.370 U	**0.850 J**	**1.40 J**
Benzo(k)fluoranthene	0.280 U	0.280 U	0.280 U	0.280 U	0.280 UJ	0.280 U
Chrysene	4.60 U	3.70 U	4.00 U	4.10 U	6.20 UJ	4.80 U
Dibenz(a,h)anthracene	0.300 U	0.300 U	0.300 U	0.300 U	0.300 UJ	0.300 U
Fluoranthene	**11.0**	**14.0**	**14.0**	**14.0**	**11.0 J**	**12.0**
Indeno(1,2,3-cd)pyrene	0.320 U	**1.40 J**	**0.830 J**	**0.800 J**	0.320 UJ	**1.50 J**
Pyrene	3.70 U	4.30 U	4.80 U	4.60 U	3.70 UJ	3.80 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclors 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Reference Area clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 6-9b
Post-Removal Reference Area Clam Tissue Analytical Results
PCB Aroclors, PCB Dioxin-Like Congeners, Metals, and Semivolatile Organic Compounds
(Page 3 of 3)

Area	Reference	Reference	Reference	Reference	Reference	Reference
Site ID	P40	P41	P42	P85	P86	P87
Sample ID	08022740TC	08022741TC	08022742TC	08030685TC	08030686TC	08030687TC
Sample Date	2/27/2008	2/27/2008	2/27/2008	3/6/2008	3/6/2008	3/6/2008
Percent Lipds	3.3	3.3	3.1	2.8	2.7	3.1
PCB Aroclors (µg/kg wet)						
Aroclor 1016	12.0 U	14.0 U	12.0 U	14.0 U	12.0 U	9.50 U
Aroclor 1221	12.0 U	7.50 U	16.0 U	12.0 U	9.10 U	9.20 U
Aroclor 1232	22.0 U	31.0 U	20.0 U	28.0 U	24.0 U	26.0 U
Aroclor 1242	9.70 U	14.0 U	9.40 U	9.90 U	9.20 U	9.50 U
Aroclor 1248	8.70 U	8.90 U	8.20 U	9.90 U	7.10 U	5.50 U
Aroclor 1254	**37.0**	**39.0**	**35.0**	**34.0**	**31.0**	**33.0**
Aroclor 1260	6.90 U	7.70 U	7.50 U	6.70 U	6.20 U	6.60 U
Aroclor 1262	9.90 U	7.80 U	9.10 U	8.20 U	7.90 U	8.40 U
Aroclor 1268	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Total PCBs as Aroclors (NDs at MDL) [1]	**37.0**	**39.0**	**35.0**	**34.0**	**31.0**	**33.0**
PCB Dioxin-Like Congeners (µg/kg wet)						
PCB 77	**0.0463**	**0.0468**	**0.0414**	**0.0408**	**0.0384**	**0.0357**
PCB 81	**0.00275**	**0.00221**	**0.00203**	0.00188 EMPC	**0.00180**	0.00151 EMPC
PCB 105	**0.535**	**0.556**	**0.488**	**0.478**	**0.440**	**0.414**
PCB 114	**0.0308**	**0.0330**	**0.0281**	**0.0271**	**0.0249**	**0.0247**
PCB 118	**2.77**	**2.82**	**2.53**	**2.64**	**2.29**	**2.27**
PCB 123	**0.0532**	**0.0506**	**0.0438**	**0.0500**	**0.0412**	**0.0409**
PCB 126	**0.00564**	**0.00536**	**0.00512**	0.00588 U	**0.00446**	**0.00451**
PCB 156	**0.158 C**	**0.161 C**	**0.145 C**	**0.137 C**	**0.123 C**	**0.125 C**
PCB 157	**PCB 156 and 157 are coeluting congeners and are represented with one concentration.**					
PCB 167	**0.146**	**0.146**	**0.137**	**0.165**	**0.123**	**0.131**
PCB 169	0.00125 U	0.00103 U	0.00101 U	0.00173 U	0.00117 U	0.00157 U
PCB 189	**0.00241**	**0.00237**	**0.00217**	**0.00201**	**0.00171**	**0.00172**
Total PCBs as Congeners (KM, capped)	**32.9 J**	**32.8 J**	**29.7 J**	**30.7 J**	**27.0 J**	**26.9 J**
Metals (mg/kg wet)						
Aluminum	**11.5**	**16.9**	**8.00**	**36.3**	**26.7**	**83.4**
Antimony	0.00400 U	**0.00800**	0.00400 U	0.00400 U	0.00400 U	0.00400 U
Arsenic	**2.41**	**2.44**	**2.26**	**2.62**	**2.09**	**2.01**
Barium	**1.82**	**1.71**	**1.87**	**1.81**	**2.02**	**2.38**
Beryllium	0.000400 U	**0.000800**	0.000400 U	0.000400 U	0.000400 U	**0.00140**
Cadmium	**0.363**	**0.347**	**0.353**	**0.405**	**0.298**	**0.328**
Chromium	**0.470**	**0.490**	**0.470**	**0.760**	**0.570**	**0.460**
Cobalt	**0.0929**	**0.0965**	**0.0902**	**0.129**	**0.138**	**0.147**
Copper	**9.94**	**9.65**	**9.10**	**11.6**	**9.24**	**9.67**
Lead	**0.0570**	**0.0600**	**0.0490**	**0.0530**	**0.0550**	**0.0720**
Mercury	**0.00620**	**0.00720**	**0.00510**	**0.00710**	**0.00640**	**0.0135**
Methyl Mercury	**0.00160**	**0.00550**	**0.00140**	**0.00320**	**0.00460**	**0.00500**
Nickel	**0.273**	**0.289**	**0.402**	**0.346**	**0.333**	**0.482**
Thallium	**0.00660**	**0.0105**	**0.00570**	**0.00610**	**0.00650**	**0.00800**
Vanadium	**0.0840**	**0.104**	**0.0740**	**0.150**	**0.127**	**0.286**
Zinc	**22.4**	**21.3**	**22.1**	**18.5**	**21.0**	**22.2**
Semivolatile Organic Compounds (µg/kg wet)						
Bis(2-ethylhexyl) Phthalate	**460**	**390**	**600**	**330**	**370**	**390**
Butyl Benzyl Phthalate	7.30 U	7.30 U	**57.0 J**	7.30 U	7.30 U	7.30 U
Carbazole	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U	9.10 U
Di-n-butyl Phthalate	16.0 U	16.0 UJ	16.0 U	35.0 U	48.0 U	16.0 U
Di-n-octyl Phthalate	11.0 U	11.0 UJ	11.0 U	11.0 U	11.0 U	11.0 U
p-cresol (4-Methylphenol)	**52.0**	**60.0**	**30.0 J**	**38.0**	**13.0 J**	**35.0 J**
Low Molecular Weight Polycyclic Aromatic Hydrodarbons (LPAHs) (µg/kg wet)						
Acenaphthene	**0.270 J**	**0.330 J**	**0.810 J**	**0.670**	**0.470**	**0.720**
Anthracene	1.60 U	1.30 UiJ	**0.850 J**	1.50 U	2.90 U	1.40 U
Fluorene	**2.00**	**1.80**	**2.30 J**	**1.90**	**1.80**	**2.20**
Phenanthrene	**8.30**	**8.80**	**8.80 J**	**8.60**	**8.20**	**10.0**
High Molecular Weight Polycyclic Aromatic Hydrodarbons (HPAHs) (µg/kg wet)						
Benzo(a)anthracene	21.0 U	26.0 UiJ	20.0 UJ	20.0 U	8.50 U	22.0 U
Benzo(a)pyrene	0.410 U	0.410 U	0.410 UJ	0.410 U	0.410 U	0.410 U
Benzo(b)fluoranthene	0.350 U	0.350 U	0.350 UJ	0.350 U	0.350 U	0.350 U
Benzo(g,h,i)perylene	**1.40 J**	**0.600 J**	0.370 UJ	0.370 U	0.370 U	0.370 U
Benzo(k)fluoranthene	0.280 U	0.280 U	0.280 UJ	0.280 U	0.280 U	0.280 U
Chrysene	5.80 U	5.10 UiJ	6.50 UJ	5.80 U	5.10 U	5.20 U
Dibenz(a,h)anthracene	0.300 U	0.300 U	0.300 UJ	0.300 U	0.300 U	0.300 U
Fluoranthene	**13.0**	**12.0**	**13.0 J**	**11.0**	**12.0**	**13.0**
Indeno(1,2,3-cd)pyrene	**2.00 J**	**1.80 J**	0.320 UJ	0.320 U	0.320 U	0.320 U
Pyrene	3.30 U	3.50 UiJ	4.00 UJ	2.90 U	3.20 U	4.10 U

Notes:

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
MDL = method detection limit
RDL = reported detection limit
ND = Non Detect
- = Not Analyzed
bold = analyte detected above MDL/RDL.
J = The reported value is an estimate.

[1] Only Aroclors 1254 was included in summing clam Total PCBs as Aroclors because all other aroclors were undected in Reference Area clam samples.
KM, capped = Kaplan–Meier-based with Efron's bias correction, capped
U = The analyte was not detected at or above the MDL (except PCB congeners).
For PCB congeners, the analyte was not detected at or above the RDL/EMPC.
UJ = The analyte was not detected. The reported MDL (non-congeners) or RDL/EMPC (congeners) is an estimate.
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.

Table 3
Forebay Clam - Analytical Results and Screening Criteria for PCB Aroclors, Metals, PAHs, Pesticides, Butyltins, and SVOCs

Area	Forebay	Forebay	Forebay	Forebay	Forebay	Selected SLV	SLV Source
Site ID	P112	P113	P114	P115	P118		
Sample ID	111019P112TC	111019P113TC	111019P114TC	111018P115TC	111018P118TC		
Sample Date	10/19/2011	10/19/2011	10/19/2011	10/18/2011	10/18/2011		
Percent Lipids	1.2	1.6	1.7	1.8	-		
PCB Aroclors (µg/kg wet)							
Aroclor 1016	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1221	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1232	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1242	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1248	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1254	**800**	**1,200**	**620**	**370**	-	0.570	HH
Aroclor 1260	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1262	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Aroclor 1268	3.40 U	28.0 U	3.40 U	3.40 U	-	0.570	HH
Total PCBs as Aroclors (NDs at MDL) [1]	**800**	**1,200**	**620**	**370**		0.570	HH
Metals (mg/kg wet)							
Aluminum	**207**	**116**	**176**	**262**	**157**	--	--
Antimony	**0.00440 J**	**0.00430 J**	**0.00480 J**	**0.00480 J**	**0.00530 J**	--	--
Arsenic	**1.64**	**1.71**	**1.98**	**1.96**	**2.24**	0.000760	HH
Barium	**2.69**	**2.34**	**2.34**	**3.19**	**2.84**	--	--
Beryllium	**0.00530**	**0.00370**	**0.00480**	**0.00720**	**0.00510**	--	--
Cadmium	**0.319**	**0.286**	**0.314**	**0.308**	**0.395**	0.150	Eco
Chromium	**0.520**	**1.02**	**0.553**	**0.805**	**0.795**	--	--
Cobalt	**0.137**	**0.0925**	**0.114**	**0.145**	**0.123**	--	--
Copper	**6.45**	**6.65**	**8.30**	**7.93**	**8.78**	--	--
Lead	**0.105**	**0.0740**	**0.107**	**0.148**	**0.107**	0.120	Eco
Mercury	**0.00700**	**0.00620**	**0.00660**	**0.00540**	-	0.0490	HH
Methyl Mercury	**0.00240**	**0.00250**	**0.00280**	**0.00280**	**0.00300**	0.0490	HH
Nickel	**0.317**	**0.297**	**0.244**	**0.361**	**0.240**	--	--
Thallium	**0.0100**	**0.00940**	**0.0107**	**0.0100**	**0.0100**	--	--
Vanadium	**0.564**	**0.324**	**0.429**	**0.610**	**0.422**	--	--
Zinc	**22.3**	**21.7**	**22.9**	**25.0**	**22.4**	--	--
Butyltins (µg/kg wet)							
Dibutyltin Cation	-	0.110 U	-	-	-	--	--
Monobutyltin	-	0.180 U	-	-	-	--	--
Tetrabutyltin	-	0.150 U	-	-	-	--	--
Tri-n-butyltin	-	0.110 U	-	-	-	150	ATLs
Pesticides (µg/kg wet)							
4,4'-DDD	**2.00**	**2.70**	**2.20**	**1.20 J**	-	--	--
4,4'-DDE	**8.40**	**8.00**	**9.50**	**10.0**	-	--	--
4,4'-DDT	**110 J**	**110 J**	**89.0 J**	**24.0 J**	-	3.40	ATLs
Aldrin	0.890 U	0.740 U	0.890 U	0.890 U	-	--	--
BHC (alpha)	**0.620 J**	**0.590 J**	**0.750 J**	**0.810 J**	-	--	--
BHC (beta)	1.30 U	**1.50**	1.50 U	2.10 U	-	--	--
BHC (delta)	1.20 U	0.500 U	**0.610 J**	1.20 U	-	--	--
BHC (gamma) Lindane	0.260 U	0.210 U	0.260 U	**0.360 J**	-	--	--
Chlordane (alpha)	1.50 U	1.60 U	1.20 U	0.300 U	-	3.30	ATLs
Chlordane (gamma)	**16.0**	**18.0**	**12.0**	**5.90**	-	3.30	ATLs
Dieldrin	9.30 U	8.60 U	6.70 U	3.10 U	-	0.0720	ATLs
Endosulfan I	5.30 U	**1.70**	**2.70**	**0.850 J**	-	--	--
Endosulfan II	0.290 U	1.00 U	0.290 U	0.290 U	-	--	--
Endosulfan Sulfate	0.640 U	0.530 U	0.640 U	0.640 U	-	--	--
Endrin	**3.80**	**4.10**	**2.90**	**1.40**	-	--	--
Endrin Aldehyde	**2.30**	**2.90**	**2.30**	**1.00 J**	-	--	--
Endrin Ketone	0.470 U	0.390 U	0.470 U	0.470 U	-	--	--
Heptachlor	0.360 U	0.400 U	0.510 U	0.570 U	-	--	--
Heptachlor Epoxide	4.40 U	4.30 U	3.20 U	1.50 U	-	--	--
Methoxychlor	0.580 U	1.00 U	1.20 U	1.20 U	-	--	--
Toxaphene	150 U	160 U	150 U	170 U	-	--	--
SVOCs (µg/kg wet)							
Acenaphthene	-	**0.740 J**	-	-	-	15,000	HH
Anthracene	-	**2.70 J**	-	-	-	15,000	HH
Benzo(a)anthracene	-	**3.50 J**	-	-	-	1.57	HH
Benzo(a)pyrene	-	**2.70 J**	-	-	-	0.157	HH
Benzo(b)fluoranthene	-	**3.20 J**	-	-	-	1.57	HH
Benzo(g,h,i)perylene	-	**2.50 J**	-	-	-	15.7	HH
Benzo(k)fluoranthene	-	**2.50 J**	-	-	-	15.7	HH
Bis(2-ethylhexyl) Phthalate	-	390 U	-	-	-	81.9	HH
Butyl Benzyl Phthalate	-	12.0 U	-	-	-	310	Eco
Carbazole	-	6.20 U	-	-	-	--	--
Chrysene	-	**6.10**	-	-	-	157	HH
Dibenz(a,h)anthracene	-	**4.20 J**	-	-	-	0.157	HH
Di-n-butyl Phthalate	-	8.20 U	-	-	-	626	Eco
Di-n-octyl Phthalate	-	5.40 U	-	-	-	626	Eco
Fluoranthene	-	**12.0**	-	-	-	19,000	Eco
Fluorene	-	**2.20 J**	-	-	-	15,000	HH
Indeno(1,2,3-cd)pyrene	-	**2.60 J**	-	-	-	1.57	HH
p-cresol (4-Methylphenol)	-	7.60 U	-	-	-	--	--
Phenanthrene	-	**10.0**	-	-	-	15,000	HH
Pyrene	-	**6.50 J**	-	-	-	1,000	Eco

Notes:
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
Eco = Ecological SLV, Bradford RI
HH = Human Health, Bradford RI
MDL = method detection limit
SLV = screening level value
- = Not Analyzed
-- = SLV for analyte not available
ATLs = Lowest ATL for Human Receptors, Table 3 of Oregon DEQ Guidance for A
Bioaccumulative Chemicals of Concern in Sediment, April 2007
ND = Non Detect
J = The reported value is an estimate.
U = The analyte was not detected at or above the MDL
UJ = The analyte was not detected. The reported MDL is an estimate.
bold = analyte detected above MDL
= The reported concentration exceeds the selected SLV

Table 7
Forebay Clam - Analytical Results and Screening Criteria for PCB Congeners
October 2011 Sampling

IUPAC #	COELUTING CONGENERS[1]	P112 111019P112T C 10/19/2011	P113 111019P113T C 10/19/2011	P114 111019P114T C 10/19/2011	P115 111018P115T C 10/18/2011	P117 111018P117T C 10/18/2011	P118 111018P118T C 10/18/2011
Individual Congeners in pg/g (ng/kg), wet weight							
1		42.2	50.4	7.11	2.78	1.75 J	5.40
2		2.24	1.93 J	1.48 J	1.33 J	1.40 J	1.20 J
3		3.58	3.01	0.990 J	1.39 J	2.170 U	2.210 U
4		1,900	3,820	1,290	325	190	512
5		6.60	4.61	2.05 J	0.868 J	0.734 J	0.858 J
6		201	122	81.0	22.4	13.8	22.7
7		36.2	13.0	4.17	1.34 J	0.672 J	1.21 J
8		408	323	111	50.0	34.2	45.5
9		82.3	35.8	11.0	3.39	1.94 J	3.18
10		106	139	25.0	8.90	3.05	10.2
11		3,040	3,270	3,100	2,920	3,360	3,660
12	12 + 13	66.8 C	48.0 C	30.6 C	21.8 C	12.6 C	19.8 C
13	12 + 13	C12	C12	C12	C12	C12	C12
14		0.158 J	0.225 U	0.137 EMPC	0.140 U	0.125 U	0.118 U
15		187	113	37.2	16.4	13.4	13.3
16		537	380	277	111	69.4	91.5
17		3,050	2,740	1,640	708	215	383
18	18 + 30	3,640 C	2,690 C	1,720 C	710 C	258 C	406 C
19		1,170	1,160	313	137	58.6	89.1
20	20 + 28	1,360 C	855 C	470 C	200 C	133 C	164 C
21	21 + 33	549 C	343 C	231 C	135 C	62.8 C	77.3 C
22		620	422	374	142	105	130
23		1.43 J	1.12 U	0.615 U	1.74 J	0.258 U	0.254 U
24		16.0	11.3	7.08	2.67	2.43	2.30
25		603	450	237	97.3	35.8	59.0
26	26 + 29	905 C	582 C	289 C	131 C	59.3 C	84.3 C
27		1,740	1,500	817	387	105	195
28	20 + 28	C20	C20	C20	C20	C20	C20
29	26 + 29	C26	C26	C26	C26	C26	C26
30	18 + 30	C18	C18	C18	C18	C18	C18
31		1,730	1,210	534	181	114	138
32		937	754	290	130	54.5	87.1
33	21 + 33	C21	C21	C21	C21	C21	C21
34		7.65	4.09	2.54	2.30	0.568 J	0.654 J
35		11.2	7.87	7.29	5.30	7.03	6.87
36		1.97 J	1.98 J	1.38 J	1.05 J	0.970 J	1.07 J
37		326	211	146	70.7	49.5	55.4
38		7.15	5.40	4.11	1.80 J	0.994 J	1.47 J
39		50.7	51.4	29.0	13.6	4.24	7.72
40	40 + 41 + 71	7,030 C	6,300 C	3,320 C	1,410 C	449 C	753 C
41	40 + 41 + 71	C40	C40	C40	C40	C40	C40
42		5,930	4,670	3,090	1,170	449	868
43		352	354	168	48.5	18.6	25.2
44	44 + 47 + 65	68,500 C	57,000 C	32,700 C	11,400 C	4,460 C	7,970 C
45	45 + 51	1,290 C	1,060 C	558 C	253 C	83.7 C	137 C
46		281	197	75.0	24.3	12.2	15.4
47	44 + 47 + 65	C44	C44	C44	C44	C44	C44
48		1,780	1,710	1,040	454	134	263
49	49 + 69	18,000 C	15,600 C	8,570 C	2,940 C	945 C	1,770 C
50	50 + 53	6,600 C	5,400 C	3,120 C	1,420 C	378 C	688 C
51	45 + 51	C45	C45	C45	C45	C45	C45
52		90,300	80,400	41,000	12,700	4,360	7,300
53	50 + 53	C50	C50	C50	C50	C50	C50
54		29.3	16.1 J	5.28 J	2.95	1.12 J	1.15 J
55		20.6 U	22.1 U	15.5 U	26.0	12.0	14.1
56		7,980	7,420	4,190	1,680	633	1,000
57		19.5 U	20.9 U	14.2 U	4.14	1.52 U	1.74 U
58		100	80.5	142	15.8	1.59 J	1.77 U
59	59 + 62 + 75	488 C	379 C	243 C	94.5 C	43.8 C	71.2 C
60		2,760	2,580	1,480	560	256	334
61	61 + 70 + 74 + 76	76,400 C	69,700 C	33,500 C	11,300 C	4,360 C	6,820 C
62	59 + 62 + 75	C59	C59	C59	C59	C59	C59
63		645	591	353	154	63.6	86.6
64		7,930	7,120	3,590	1,190	468	787
65	44 + 47 + 65	C44	C44	C44	C44	C44	C44
66		24,000	21,800	12,600	5,170	2,120	3,020
67		132	82.2	67.6	42.9	13.9	23.7
68		71.6	37.3	33.1	17.4	7.98	10.0
69	49 + 69	C49	C49	C49	C49	C49	C49
70	61 + 70 + 74 + 76	C61	C61	C61	C61	C61	C61
71	40 + 41 + 71	C40	C40	C40	C40	C40	C40
72		66.6	37.9	28.8	14.5	7.26	9.06
73		207	127	68.8	21.5	12.8	15.5
74	61 + 70 + 74 + 76	C61	C61	C61	C61	C61	C61
75	59 + 62 + 75	C59	C59	C59	C59	C59	C59
76	61 + 70 + 74 + 76	C61	C61	C61	C61	C61	C61
77		286	269	209	110	57.5	64.2
78		20.9 U	22.4 U	15.6 U	2.95 U	1.57 U	1.80 U
79		3,060	2,880	1,820	708	262	538
80		18.6 U	19.9 U	14.0 U	2.68 U	1.43 U	1.63 U
81		37.4 EMPC	66.9 EMPC	40.1 EMPC	8.76 EMPC	3.95 EMPC	5.19 EMPC
82		6,370	6,510	2,920	926	422	561
83	83 + 99	91,600 C	91,100 C	59,300 C	24,400 C	7,380 C	13,200 C
84		16,700	16,100	6,740	2,180	936	1,350
85	85 + 116 + 117	21,300 C	21,500 C	12,800 C	5,250 C	1,970 C	2,920 C
86	86 + 87 + 97 + 108 + 119 + 125	108,000 C	101,000 C	58,800 C	22,000 C	8,970 C	15,900 C
87	86 + 87 + 97 + 108 + 119 + 125	C86	C86	C86	C86	C86	C86
88	88 + 91	13,600 C	13,400 C	6,920 C	2,800 C	945 C	1,690 C
89		476	486	226	79.5	31.5	50.1
90	90 + 101 + 113	196,000 C	179,000 C	79,900 C	35,400 C	11,900 C	21,400 C
91	88 + 91	C88	C88	C88	C88	C88	C88
92		15,400	15,200	8,160	3,180	1,080	1,860
93	93 + 95 + 98 + 100 + 102	122,000 C	114,000 C	63,300 C	23,900 C	7,950 C	15,700 C
94		191	183	84.8	26.9	9.29	17.3
95	93 + 95 + 98 + 100 + 102	C93	C93	C93	C93	C93	C93
96		213	207	86.8	23.4	11.4	15.3
97	86 + 87 + 97 + 108 + 119 + 125	C86	C86	C86	C86	C86	C86
98	93 + 95 + 98 + 100 + 102	C93	C93	C93	C93	C93	C93
99	83 + 99	C83	C83	C83	C83	C83	C83
100	93 + 95 + 98 + 100 + 102	C93	C93	C93	C93	C93	C93
101	90 + 101 + 113	C90	C90	C90	C90	C90	C90
102	93 + 95 + 98 + 100 + 102	C93	C93	C93	C93	C93	C93
103		246	221	114	38.5	11.5	25.5
104		2.19 J	1.75 J	0.770 J	1.29 J	0.205 EMPC	0.343 J
105		56,500	55,900	36,400	15,400	6,140	8,170
106		16.7 U	18.1 U	17.1 U	7.08 U	5.33 U	6.51 U
107	107 + 124	4,800 C	4,910 C	2,940 C	1,230 C	471 C	686 C
108	86 + 87 + 97 + 108 + 119 + 125	C86	C86	C86	C86	C86	C86
109		7,590	7,600	4,680	2,210	908	1,140
110	110 + 115	183,000 C	169,000 C	68,100 C	29,700 C	11,100 C	18,200 C
111		10.0 U	10.2 U	6.31 U	1.34 U	0.197 U	1.23 U
112		9.61 U	9.80 U	5.86 U	1.35 U	0.198 U	1.24 U
113	90 + 101 + 113	C90	C90	C90	C90	C90	C90
114		3,320	3,280	2,290	1,020	426	533
115	110 + 115	C110	C110	C110	C110	C110	C110
116	85 + 116 + 117	C85	C85	C85	C85	C85	C85
117	85 + 116 + 117	C85	C85	C85	C85	C85	C85
118		237,000 J	224,000 J	118,000 J	65,000 J	29,900 J	44,500 J
119	86 + 87 + 97 + 108 + 119 + 125	C86	C86	C86	C86	C86	C86
120		23.5	22.2	16.7 J	13.0	5.96	10.9 EMPC
121		9.43 U	9.61 U	6.02 U	1.34 U	0.196 U	1.22 U
122		875	824	481	216	89.2	117
123		3,890	3,760	2,560	1,070	591	817
124	107 + 124	C107	C107	C107	C107	C107	C107
125	86 + 87 + 97 + 108 + 119 + 125	C86	C86	C86	C86	C86	C86
126		42.3	56.5	35.1	14.0	6.78	10.3
127		161	166	115	52.3	20.3	27.5
128	128 + 166	15,300 C	14,700 C	8,970 C	3,300 C	1,470 C	1,870 C
129	129 + 138 + 160 + 163	173,000 C	165,000 C	114,000 C	45,300 C	20,800 C	29,900 C
130		5,520	5,350	3,420	1,360	584	748
131		1,250	1,200	679	263	91.9	150
132		21,000	20,400	11,100	4,090	1,710	2,390
133		794	782	541	222	86.3	121
134	134 + 143	3,320 C	3,280 C	1,960 C	679 C	266 C	392 C
135	135 + 151 + 154	13,900 C	13,300 C	7,830 C	2,900 C	1,000 C	1,820 C
136		5,510	5,250	2,690	969	404	583
137		6,640	6,660	4,460	2,190	823	1,120
138	129 + 138 + 160 + 163	C129	C129	C129	C129	C129	C129
139	139 + 140	1,980 C	1,970 C	1,220 C	469 C	136 C	270 C
140	139 + 140	C139	C139	C139	C139	C139	C139
141		2,920	3,640	1,880	889	344	426
142		13.3 J	18.3 J	19.9 U	4.25 U	4.78 U	3.65 U
143	134 + 143	C134	C134	C134	C134	C134	C134

Table 7
Forebay Clam - Analytical Results and Screening Criteria for PCB Congeners
October 2011 Sampling

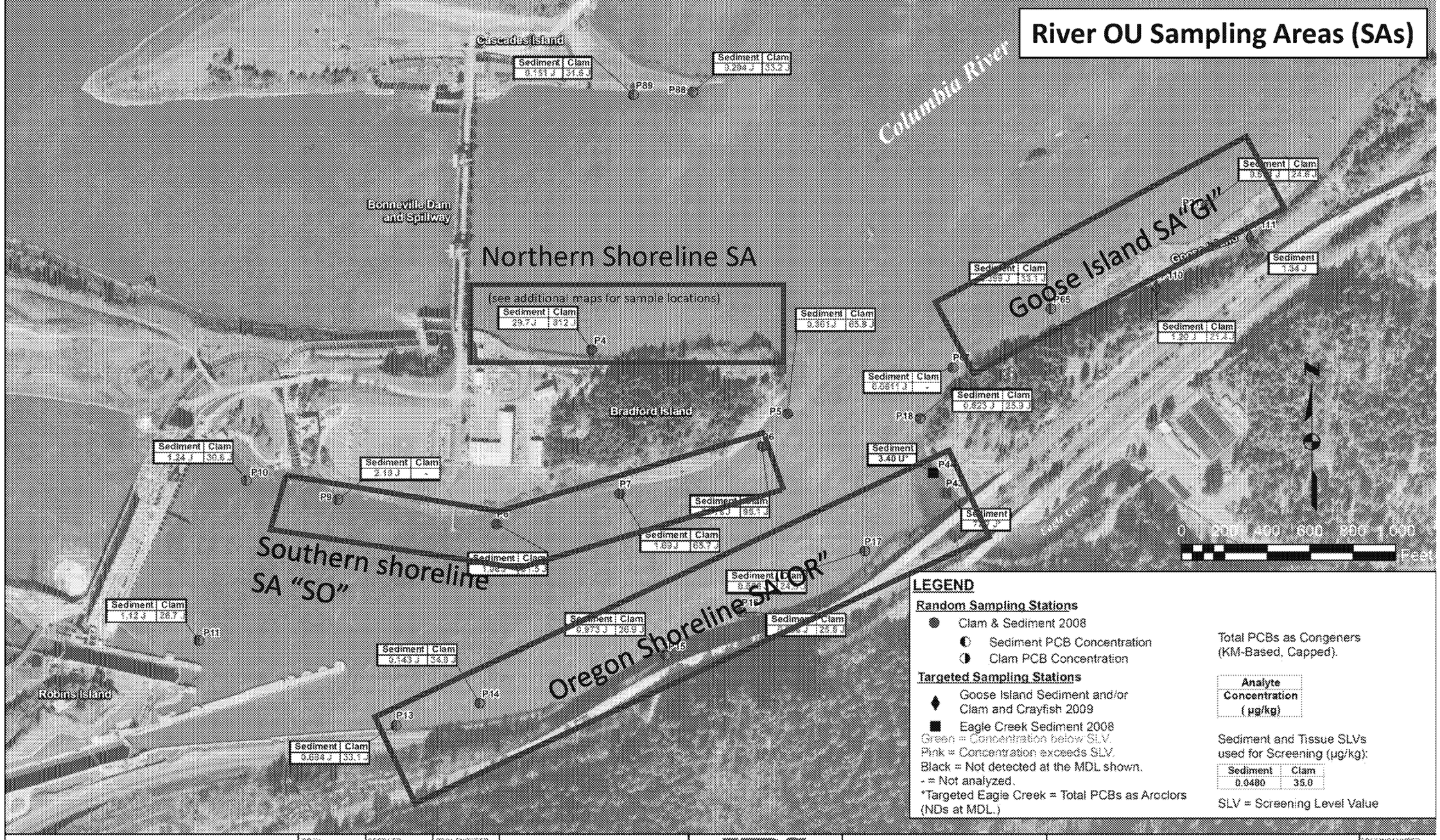
IUPAC #	COELUTING CONGENERS[1]	P112 111019P112T C 10/19/2011	P113 111019P113T C 10/19/2011	P114 111019P114T C 10/19/2011	P115 111018P115T C 10/18/2011	P117 111018P117T C 10/18/2011	P118 111018P118T C 10/18/2011
144		2,300	2,250	1,350	498	169	298
145		33.7	32.8	16.1 J	5.83	2.19	3.56
146		14,800	14,200	10,700	5,270	2,060	3,030
147	147 + 149	70,600 C	69,400 C	44,900 C	16,900 C	6,570 C	11,200 C
148		36.4	37.3	20.9 J	8.76	1.69 J	5.90
149	147 + 149	C147	C147	C147	C147	C147	C147
150		53.7	52.5	29.9	10.5	3.76	6.91
151	135 + 151 + 154	C135	C135	C135	C135	C135	C135
152		64.2	63.0	33.0	10.3	3.68	6.72
153	153 + 168	183,000 C	149,000 C	120,000 C	47,400 C	23,000 C	46,500 C
154	135 + 151 + 154	C135	C135	C135	C135	C135	C135
155		1.28 EMPC	0.814 J	1.15 EMPC	1.25 J	0.736 J	0.708 J
156	156 + 157	15,500 C	14,700 C	11,100 C	4,820 C	2,120 C	2,960 C
157	156 + 157	C156	C156	C156	C156	C156	C156
158		13,000	12,800	8,460	3,540	1,230	1,980
159		25.5	38.1	22.7	8.23	4.56	4.94 EMPC
160	129 + 138 + 160 + 163	C129	C129	C129	C129	C129	C129
161		8.68 U	6.75 U	14.0 U	2.97 U	3.34 U	2.55 U
162		279	276	171	72.8	34.1	40.4
163	129 + 138 + 160 + 163	C129	C129	C129	C129	C129	C129
164		3,170	3,360	1,990	737	273	398
165		9.35 J	8.43 EMPC	16.0 U	3.46 U	3.89 U	3.19
166	128 + 166	C128	C128	C128	C128	C128	C128
167		9,110	7,680	6,090	2,500	1,320	2,530
168	153 + 168	C153	C153	C153	C153	C153	C153
169		9.50 U	7.01 U	15.5 U	3.10 U	2.79 U	2.63 U
170		1,780	1,760	1,130	496	214	232
171	171 + 173	1,880 C	1,800 C	1,150 C	481 C	235 C	303 C
172		129	137	85.9	35.2	22.9	20.6
173	171 + 173	C171	C171	C171	C171	C171	C171
174		850	975	491	217	114	122
175		166	164	109	48.4	17.1	29.2
176		494	488	299	132	63.7	89.9
177		2,620	2,470	1,690	735	397	483
178		696	662	486	224	93.1	155
179		1,110	1,110	649	308	164	229
180	180 + 193	6,310 C	5,720 C	4,300 C	2,130 C	1,180 C	1,960 C
181		224	210	144	60.2	23.2	33.3
182		23.9	25.7	16.4	8.15	1.74 J	3.62
183	183 + 185	3,540 C	3,370 C	2,390 C	1,110 C	453 C	736 C
184		7.09	7.04	4.76	2.63	0.784 J	2.10 J
185	183 + 185	C183	C183	C183	C183	C183	C183
186		1.17 J	1.48 J	0.746 J	0.316 EMPC	0.182 EMPC	0.164 J
187		5,520	4,920	3,770	1,890	831	1,280
188		6.45	6.42	4.46	2.26	1.31 J	1.66 J
189		85.1	84.8	55.7	23.8	10.6	11.9
190		1,540	1,390	981	447	276	342
191		203	200	130	62.6	28.1	32.9
192		0.460 U	0.316 U	0.201 U	0.140 U	0.181 U	0.130 U
193	180 + 193	C180	C180	C180	C180	C180	C180
194		79.1	69.6	53.2	28.0	24.9	17.8
195		171	161	118	66.7	48.3	45.7
196		114	108	74.3	47.1	23.5	27.7
197	197 + 200	53.6 C	47.4 C	34.2 C	22.0 C	9.74 C	14.0 C
198	198 + 199	189 C	193 C	123 C	84.7 C	43.0 C	47.4 C
199	198 + 199	C198	C198	C198	C198	C198	C198
200	197 + 200	C197	C197	C197	C197	C197	C197
201		110	92.4	74.1	41.9	16.1	29.4
202		225	193	155	84.6	55.7	69.9
203		573	531	371	229	132	238
204		0.169 U	0.206 EMPC	0.151 EMPC	0.0710 EMPC	0.0690 U	0.0790 EMPC
205		25.9	22.6	17.4	9.16	5.26	7.18
206		80.5	67.8	52.0	31.1	17.3	20.5
207		15.5	12.5	10.2	6.46	2.84	4.42
208		23.7	20.9	16.9	11.1	7.05	7.83
209		13.7	14.4	11.8	8.33	8.21	9.34

Maximum Detected Concentration	237,000 J	224,000 J	120,000 C	65,000 J	29,900 J	46,500 C	**Total PCB SLV**
Minimum Detected Concentration	0.158 J	0.206 EMPC	0.137 EMPC	0.0710 EMPC	0.182 EMPC	0.0790 EMPC	**pg/g**
Total of Detected Concentrations	2,028,891 J	1,878,113 J	1,081,706 J	449,113 J	184,887 J	303,131 J	570

Notes:

C = Concentration represents coeluting congeners.
U = The analyte was not detected above the RDL.
J = The reported value is an estimate.
UJ = The analyte was not detected. The RDL is an estimate.
ng/kg = nanogram/kilogram
pg/g = picograms/gram
EMPC = The analyte was not positively identified; the associated numerical value is the Estimated Maximum Potential Concentration.
[1]= When two or more congeners can not be resolved in the chromatogram they are considered to be 'coeluting' and are reported as a single concentration. This concentration is reported once for all the coeluting congeners.
RDL = Reported detection limit

Appendix B: Maps



JOB No. 25666528	DESIGNED LSM	PROJ. ENGINEER LSM
	DRAWN BY SB	APPROVED BY MP
	CHECKED BY	DATE

URS
111 S.W. Columbia, Suite 1500
Portland, Oregon 97201
(tel) 503-220-7282

BRADFORD ISLAND

CASCADE LOCKS, OREGON

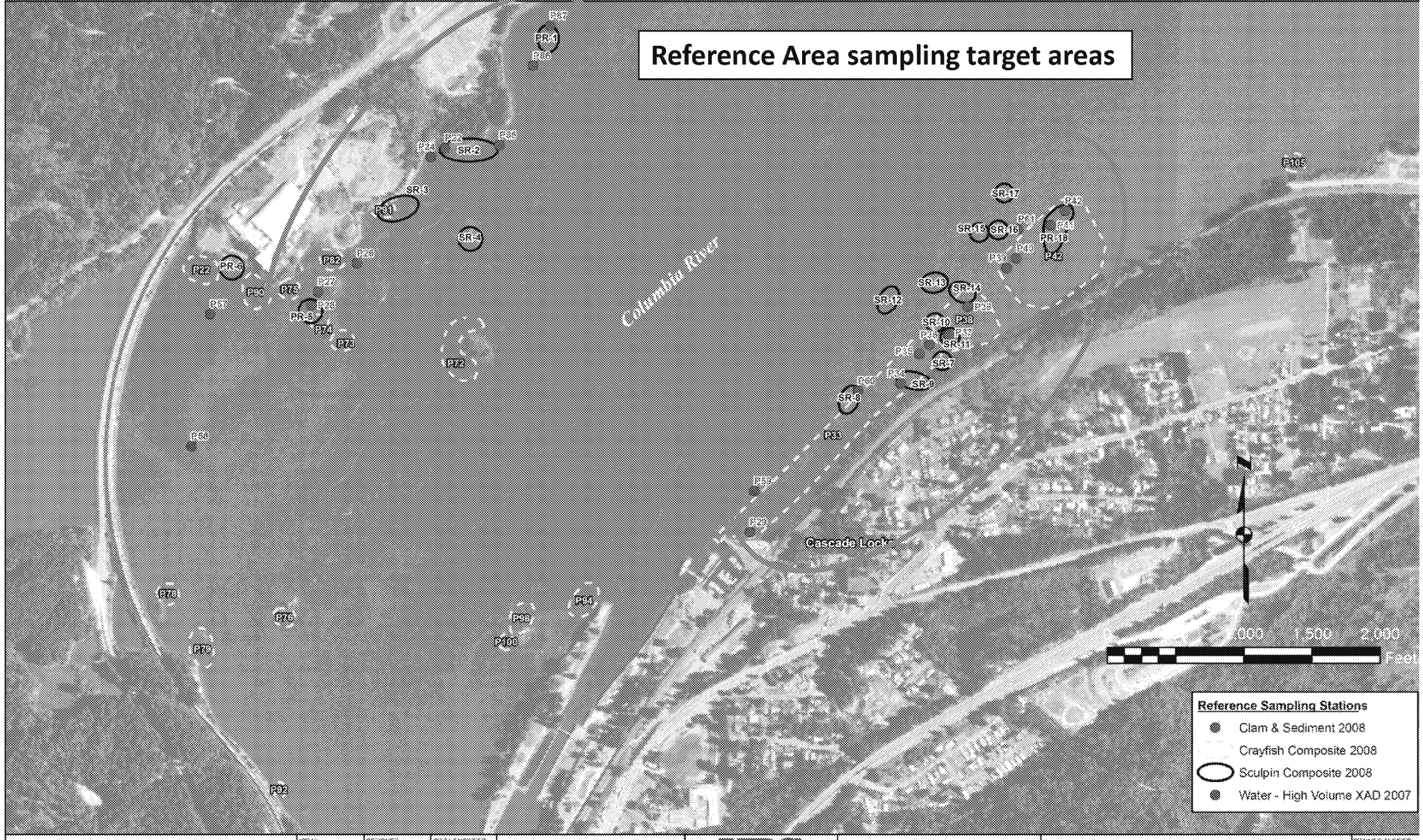
RIVER OPERABLE UNIT

FOREBAY TOTAL PCBs AS CONGENERS IN SEDIMENT AND CLAM TISSUE

DRAWING NUMBER: FIGURE 9-14g

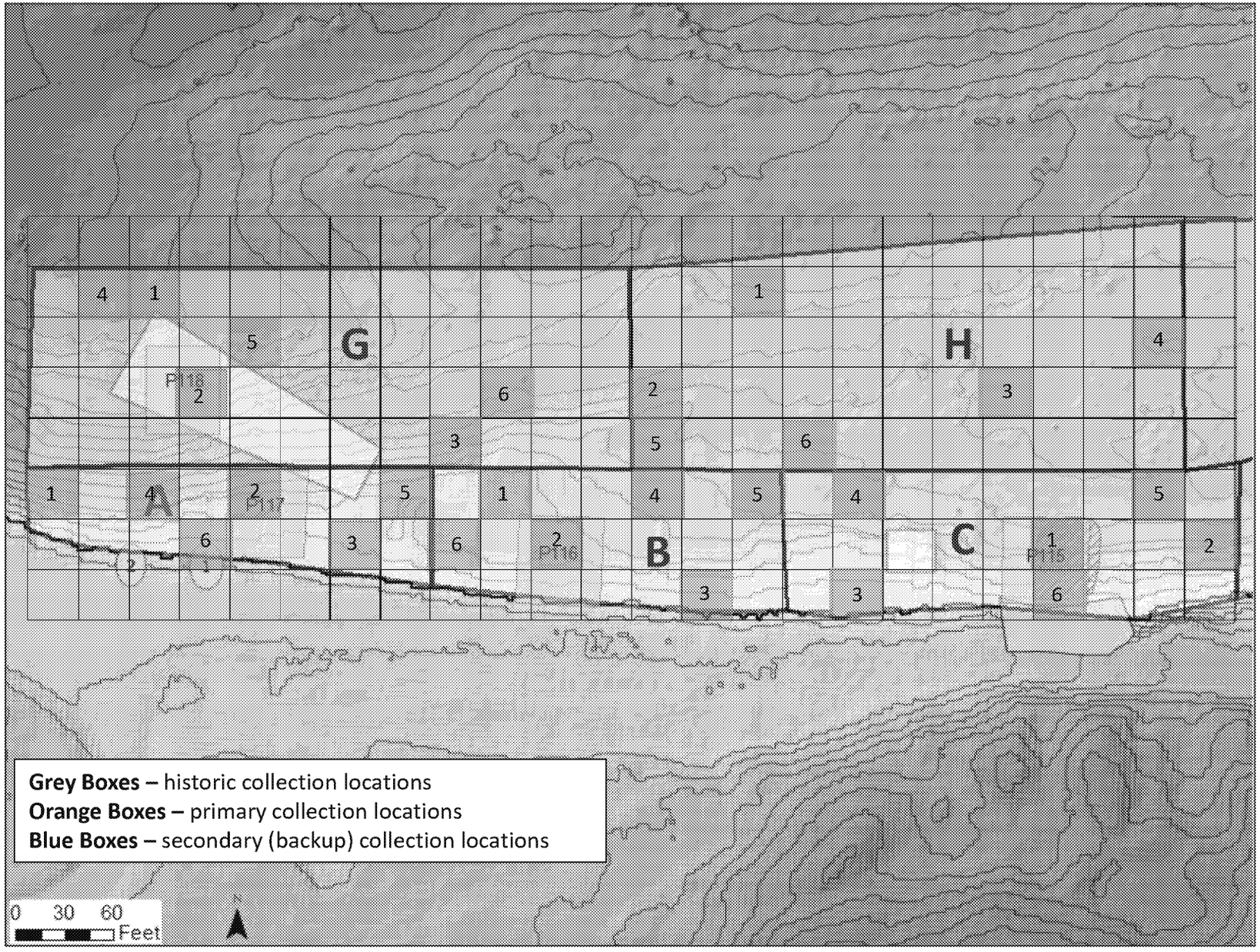
JOB FILE NUMBER: FIG 9-14g

SHEET: REV:

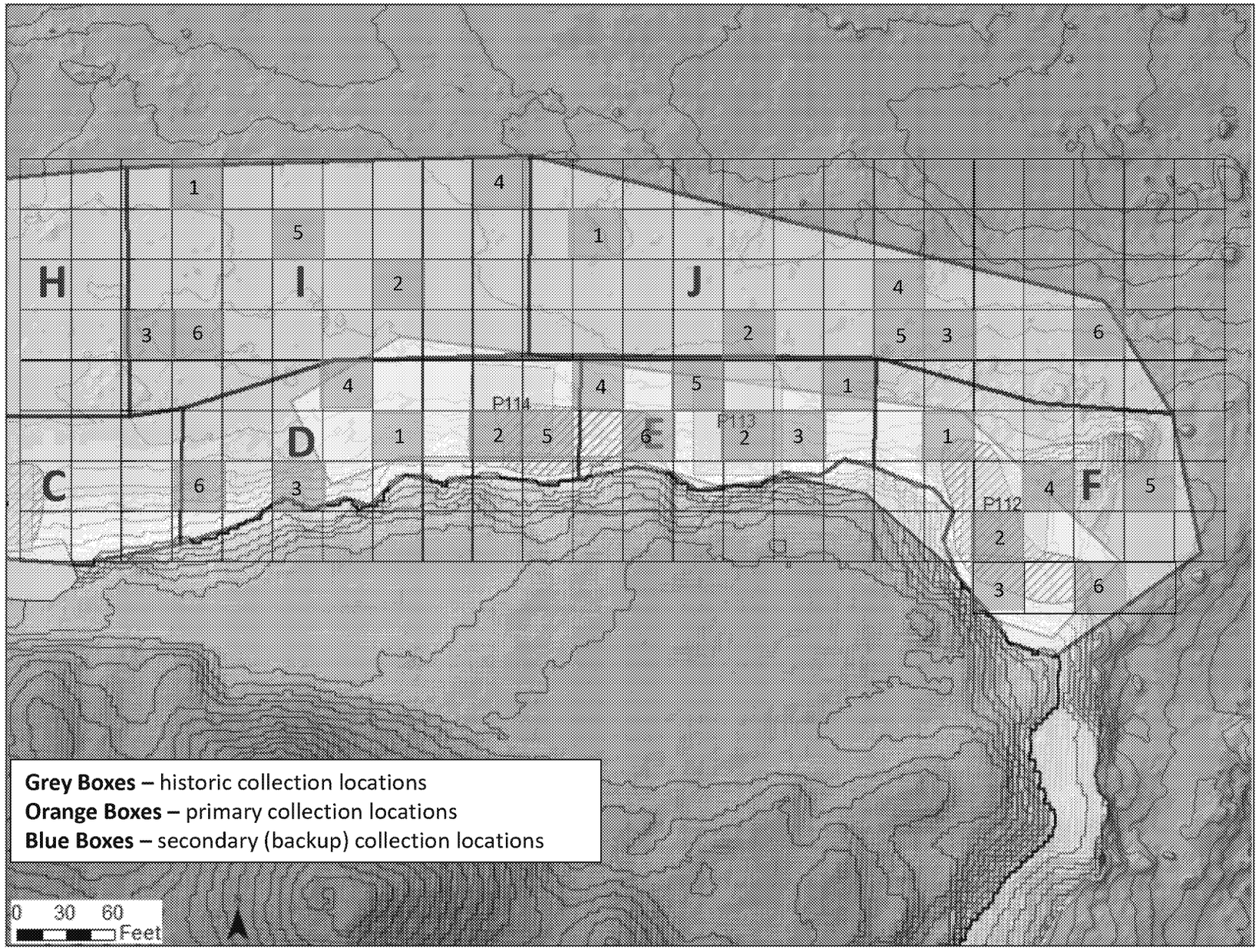


JOB No. 25606528	DESIGNED: LSM	PROJ. ENGINEER: LSM	URS 111 S.W. Columbia, Suite 1500 Portland, Oregon 97201 ph: 503-222-7200	BRADFORD ISLAND CASCADE LOCKS, OREGON	RIVER OPERABLE UNIT REFERENCE AREA SAMPLING STATIONS
	DRAWN BY: SB	APPROVED BY: MP			DRAWING NUMBER: FIGURE 6-4
	CHECKED BY:	DATE:			JOB FILE NUMBER: FIG 6-4

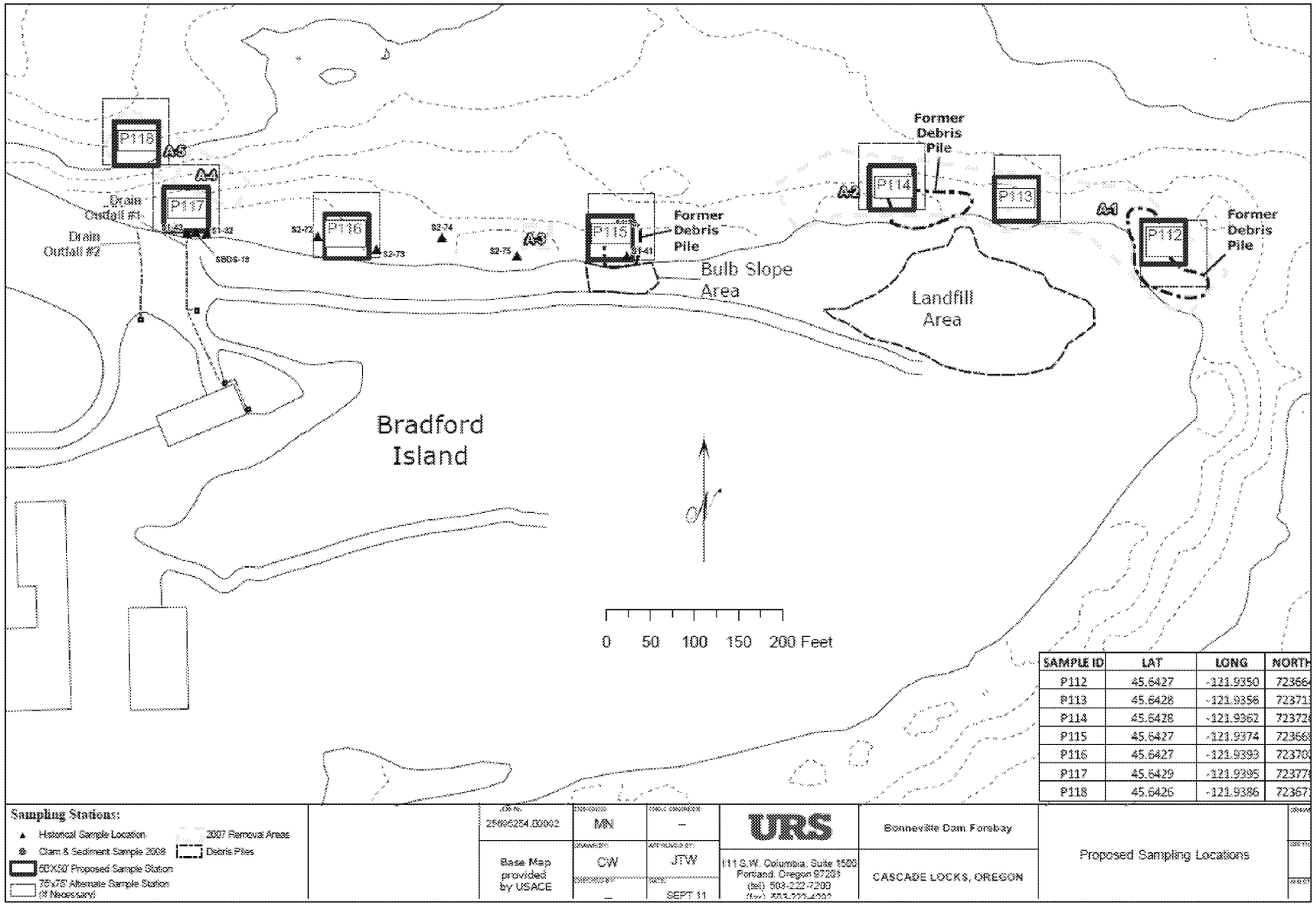
Bradford Island North Shore Clam Sample Locations - West



Bradford Island North Shore Clam Sample Locations – East



Bradford Island North Shore Historic Sampling Locations (for reference only)



SAMPLE ID	LAT	LONG	NORTH
P112	45.6427	-121.9350	72366
P113	45.6428	-121.9356	72371
P114	45.6428	-121.9362	72372
P115	45.6427	-121.9374	72366
P116	45.6427	-121.9393	72370
P117	45.6429	-121.9395	72377
P118	45.6426	-121.9386	72367

Appendix C: Field Forms

Field Form (to be completed by USACE staff)
Project: Bradford Island River OU Clam Sampling

Sample Location Number:	Date:
Weather Conditions:	Time:
Analyses	
_____Archive	
Sample Collection	
Sample Method:	
QC Samples Collected:	
Number of *Corbicula* (alive):	
Number of *Corbicula* (dead):	
Sample Team:	

Tissue Description

Specimen ID#	Species	Length (cm)	Width (cm)	Mass (g)	Comments

PAGE #:_____

Appendix D: Job Hazard Analysis (JHA) and supplemental COVID-19 information – *not provided with draft; will be included with final QAPP*

Appendix E: ERDC 153 PCB Congeners with Detection Limits and Reporting Limits

Appendix E. PCB Congeners and Laboratory Limits

ERDC list of 153 PCB congeners analyzed by modified EPA method 8082, with reporting limits (RLs) and detection limits (DLs).

Analyte	RL (ug/kg)	DL (ug/kg)	Notes
PCB 1	0.2	0.015	
PCB 10	0.1	0.075	
PCB 100/67	0.2	0.015	Co-eluters
PCB 101/90	0.2	0.015	Co-eluters
PCB 103	0.1	0.075	
PCB 104	0.1	0.075	
PCB 105	0.1	0.075	
PCB 107	0.1	0.075	
PCB 110	0.1	0.075	
PCB 114	0.1	0.075	
PCB 115/87	0.2	0.015	Co-eluters
PCB 117/81	0.2	0.015	Co-eluters
PCB 118	0.1	0.075	
PCB 119	0.1	0.075	
PCB 12	0.1	0.075	
PCB 121	0.1	0.075	
PCB 122	0.1	0.075	
PCB 124	0.1	0.075	
PCB 126	0.1	0.075	
PCB 128	0.1	0.075	
PCB 129	0.1	0.075	
PCB 13	0.1	0.075	
PCB 130	0.1	0.075	
PCB 131	0.1	0.075	
PCB 132	0.1	0.075	
PCB 134	0.1	0.075	
PCB 135	0.1	0.075	
PCB 136	0.1	0.075	
PCB 137	0.1	0.075	
PCB 138/163/164	0.3	0.0225	Co-eluters
PCB 14	0.1	0.075	
PCB 141	0.1	0.075	
PCB 142	0.1	0.075	
PCB 144	0.1	0.075	
PCB 146	0.1	0.075	
PCB 147	0.1	0.075	
PCB 149/123	0.2	0.015	Co-eluters
PCB 15	0.1	0.075	
PCB 151	0.1	0.075	
PCB 153	0.1	0.075	
PCB 154	0.1	0.075	
PCB 155	0.1	0.075	
PCB 156	0.1	0.075	
PCB 157/201	0.2	0.015	Co-eluters
PCB 158	0.1	0.075	
PCB 16	0.1	0.075	

PCB 165	0.1	0.075	
PCB 167	0.1	0.075	
PCB 169	0.1	0.075	
PCB 17	0.1	0.075	
PCB 170/203	0.2	0.015	Co-eluters
PCB 171	0.1	0.075	
PCB 172	0.1	0.075	
PCB 173	0.1	0.075	
PCB 174	0.1	0.075	
PCB 175	0.1	0.075	
PCB 176	0.1	0.075	
PCB 177	0.1	0.075	
PCB 178	0.1	0.075	
PCB 179	0.1	0.075	
PCB 18	0.1	0.075	
PCB 180	0.1	0.075	
PCB 183	0.1	0.075	
PCB 184	0.1	0.075	
PCB 185	0.1	0.075	
PCB 187	0.1	0.075	
PCB 189	0.1	0.075	
PCB 19	0.1	0.075	
PCB 190	0.1	0.075	
PCB 191	0.1	0.075	
PCB 192	0.1	0.075	
PCB 193	0.1	0.075	
PCB 194	0.1	0.075	
PCB 195	0.1	0.075	
PCB 196	0.1	0.075	
PCB 197	0.1	0.075	
PCB 199	0.1	0.075	
PCB 200	0.1	0.075	
PCB 202	0.1	0.075	
PCB 204	0.1	0.075	
PCB 205	0.1	0.075	
PCB 206	0.1	0.075	
PCB 207	0.1	0.075	
PCB 208	0.1	0.075	
PCB 209	0.1	0.075	
PCB 22	0.1	0.075	
PCB 24 /27	0.2	0.015	Co-eluters
PCB 25	0.1	0.075	
PCB 26	0.1	0.075	
PCB 28/31	0.2	0.015	Co-eluters
PCB 29/54	0.2	0.015	Co-eluters
PCB 3	0.2	0.015	
PCB 32	0.1	0.075	
PCB 33/20	0.2	0.015	Co-eluters
PCB 34	0.1	0.075	
PCB 35	0.1	0.075	
PCB 36	0.1	0.075	
PCB 37	0.1	0.075	
PCB 4	0.1	0.075	

PCB 40/71	0.2	0.015	Co-eluters
PCB 41	0.1	0.075	
PCB 42	0.1	0.075	
PCB 44	0.1	0.075	
PCB 45	0.1	0.075	
PCB 46	0.1	0.075	
PCB 47/48/75	0.3	0.0225	Co-eluters
PCB 49	0.1	0.075	
PCB 5	0.1	0.075	
PCB 51	0.1	0.075	
PCB 52	0.1	0.075	
PCB 53	0.1	0.075	
PCB 56/60	0.2	0.015	Co-eluters
PCB 59	0.1	0.075	
PCB 6	0.1	0.075	
PCB 63	0.1	0.075	
PCB 64	0.1	0.075	
PCB 66/93	0.2	0.015	Co-eluters
PCB 69	0.1	0.075	
PCB 7	0.1	0.075	
PCB 70	0.1	0.075	
PCB 73	0.1	0.075	
PCB 74	0.1	0.075	
PCB 77	0.1	0.075	
PCB 78	0.1	0.075	
PCB 8	0.1	0.075	
PCB 82	0.1	0.075	
PCB 83	0.1	0.075	
PCB 84	0.1	0.075	
PCB 85	0.1	0.075	
PCB 9	0.1	0.075	
PCB 91	0.1	0.075	
PCB 92	0.1	0.075	
PCB 95	0.1	0.075	
PCB 97	0.1	0.075	
PCB 99	0.1	0.075	